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Kenneth H. Condit
Fred H. Colvin

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MEETING THE PROBLEMS *of the* CONTRACT SHOP

A modern type of contract shop

By George S. Brady
Associate Editor, American Machinist

WIDE knowledge of the general class of work being undertaken, the most modern equipment available, and a corps of competent, dependable mechanics are the points that are becoming recognized as the fundamentals of the successful contract shop. The old-type contract shop, known as the "jobbing shop," with its motley assortment of second-hand machines and its country-garage atmosphere of puttering out the job, adding a profit and billing to a customer, is a thing of the past when it comes to getting worth-while contracts in present-day competition in industrial centers. More highly organized manufacturing plants and better distribution systems have taken a large scale of work away from the jobbing shop in the last two decades, because manufacturers now follow up their sales with a ready supply of repair parts on short notice, and the jobbing shop is now seldom able to get indefinite machine repair jobs on a cost-plus basis, except on very special jobs or in detached localities. New mechanical equipment, moreover, is now generally being brought out by established manufacturing plants, and there are fewer inventors seeking jobbing shops to build their first machines. The best jobs now available for the contract shop are "overflows" from the production factories, new tools and fixtures for these plants, special machinery, and repairs for mills. The companies that are giving out contract jobs today usually have a very good idea themselves of what the job is worth. In the case of special machinery, they also know in advance how much they can afford to pay as the initial cost of the equipment to make it pay for itself in production, and this is also true of the tool and die work given out. Furthermore, when the present-day contract job is complete, it usually has to stand the inspection and

> Every manufacturing plant has occasions when it looks outside to have special machinery or tools built, or repair work done. Giving the contract shop a square deal and a chance to do more than break even, therefore, instead of treating it as a parasite, will often bring returns in new ideas and developments

The first of three articles. The second will appear in an early issue.

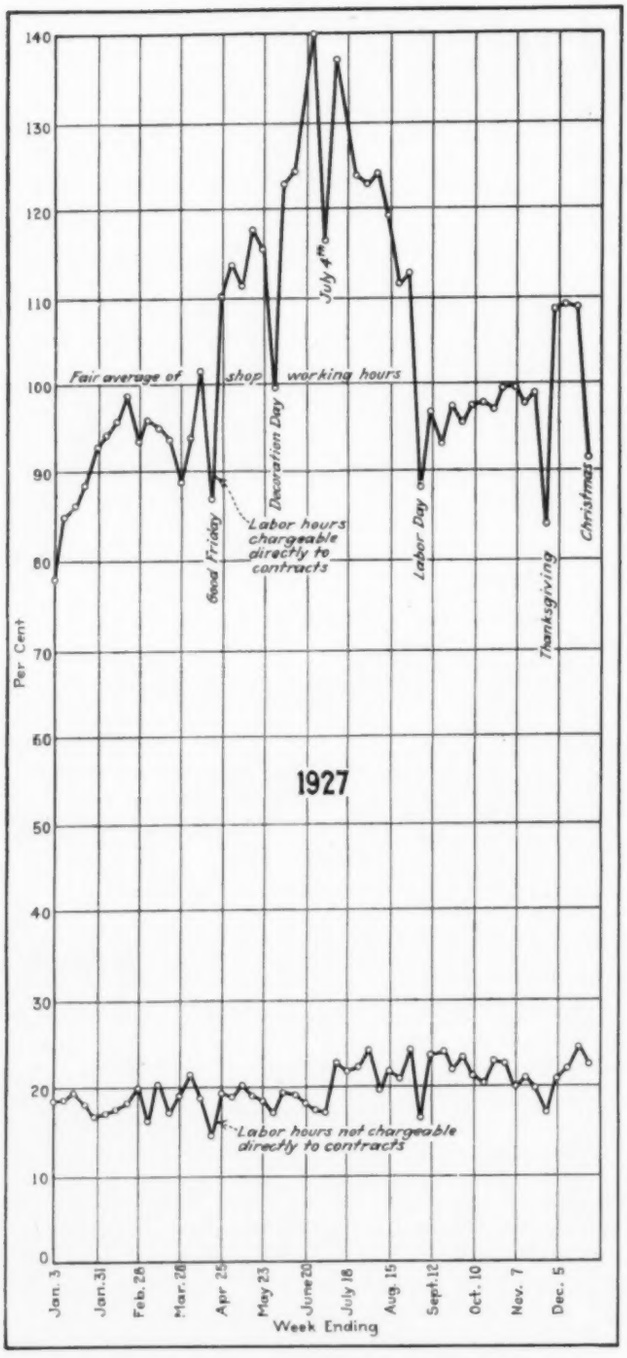


Fig. 1—Chart showing ratio of overhead and maintenance hours to direct labor hours chargeable to contract jobs in a modern progressive contract shop. The graph was plotted by hours for shop use, but is here scaled to percentage for convenience. The work of this particular shop is shown to be seasonal, and reaches its peak in the summer. The ideal contract shop would have its work selected so as to avoid heavy peaks and depressions

criticism of engineers who have very definite ideas of what to expect in the best mechanical work. There is seldom any opportunity to "make-up" for deficiencies by telling of pioneer experimental work that had to be done. In other words, the contract shop today may gain in specific experience by doing work, but it cannot expect to gain its general experience at the expense of any client. It is usually expected to offer a competitive bid, and to deliver a modern, high-class product for the stated price. Its ability to bid, and its equipment to do the work at the least cost, determines its profit and its final ability to keep going.

Repair work for mills, including cotton mills, textile factories, sugar refineries, tobacco-products manufactories, and a host of others was at one time the chief work of thousands of contract shops in all parts of the country. But, for some time past, much of this work has been gradually slipping out of their reach, because of the fact that mills are building up better maintenance departments within their own plants. Cost of the work has not been a factor in this loss as much as the time saved by having a repair department under instantaneous control of the mill management. As a definite example, the chief engineer of a refinery cited the case of paying five times the outside cost price of a special gear to save half a day's extra tie-up of a line of production machinery costing the firm more than $1,000 an hour. The extra $100 paid for overtime work on the gear was insignificant alongside of a few hours saved in the mill.

Must Show Versatility

On this point of quick delivery for repair parts, the "jobbing shops" in general have not met the needs of industry. And they stand to lose all of the mill repair work unless they can show the utmost versatility and capacity for delivering exactly what the mill engineer wants in the time specified by him. There are numerous examples available of how the mill puts pressure on to speed up a repair job, such as the case of putting a gang of eleven men to assembling one machine at a cost of $10 an hour, even if by doing so only a short time was saved over the time required by two men to do the same work. Or the case of switching in an extra man on the job during the noon-hour to run through a machine cut.

On the other hand, the answer of the contract shop manager is that while the mill engineer will countenance mad rushes in his own plant he may not recognize their costly features when it comes to paying out actual cash for having the work rushed outside. In other words, he would not pay an outsider $100 for making a gear ordinarily worth $20. This is true, but the contract shop can have the very decided advantages of wider variety of up-to-date equipment available for repair work, and greater versatility in the men available for the job. It should, therefore, be in a better position to turn out a high-class job in a shorter time on a piece of special equipment, or on a repair part, than can be done by the production plant whose main business of producing a given product takes up most of its time.

In analyzing the field of the contract shop, it might be well, first, to analyze the contract shop itself from the standpoint of its ultimate aims. Contract shops, as generally known in this country, may be divided into several groups, although it cannot be said that there is usually any sharp dividing line between the groups. In fact, some of the most successful contract shops are working within the limits of more than one group field at one time. The general classes are: Contract tool and die shop, the special machinery plant, the general contract shop, the jobbing machine shop, and the production plant that seeks contract work to fill up excess equipment. This does not take into consideration the maintenance shops operated by production plants for repair and development work strictly for themselves, nor the "service department" of large industrial plants which are operated for the production and supply of renewal parts on old models discontinued in regular production. The latter type of shop is very much a contract shop, but as

it never varies its direct line of work, and works from original production standards, it will not be considered in this discussion.

The contract tool and die shop and the special machinery shop are probably the most stable when considered together as groups. No matter how efficient the production plant may become, there will always be a field open to these contract shops. Even the large manufacturer can seldom afford to maintain enough toolmakers and highly-skilled mechanics to handle any type of work likely to come up, and the small and average size plants with few toolmakers cannot break down their special tool work and put it on an extensive enough production basis to compete in cost with the well-regulated tool contract shop. Therefore, the production plants must continue to give out much of their tool work, and practically all of their special machinery work. Viewed from the other angle, the efficient tool contract shop that manages to obtain and hold regular clients becomes, in effect, the tool department of a number of manufacturing plants, and thereby secures enough tool work to put it on a production basis, and permit it to acquire a range of equipment that would be impossible to attain in any single one of its client's plants.

The getting of business and the determination of work policies in the contract shop depend largely upon the individual operating the plant, and upon the geographic location. In few cases does the shop start out on a definite plan of work and continue in the same class of business throughout. Usually, the nature of the first successful jobs done for its clients determines the general trend of the future work. Shops in mill sections are usually occupied with repair work for the mills, or in building special machinery for them. Contract shop work is ordinarily localized, because the nature of the work being done requires personal contact between the shop and the customer. But in the case of die and tool work, the range of distance of the customers is materially increased since the work is either done to drawings or to part requirements, and does not need the close attention of the customer.

Few of the contract shops have organized sales forces, the getting of new work depending upon the personal solicitation of the management, upon advertisements in the trade papers, or from established customers. In some cases, however, one of the partners will give the major part of his time to sales efforts, and to contact work with the customers. One large contract shop in New Jersey, having more than 150 employees, has a salesman on the road at all times getting the jobs necessary to keep the work of the shop balanced. It is highly important that this balance be maintained if the contract shop is to keep its great variety of equipment operating so as to reduce the overhead on each machine, and if it is to keep its employees steadily employed on work suited to their capabilities.

Most contract shops will take on production work if the occasion arises, and it frequently happens that an initial contract development job will grow into a steady production job. On the other hand, some contract shops and jobbing shops are always on the lookout for a suitable product that they can manufacture regularly. In this way the average contract shop is in a state of evolution. Many of the present large manufacturing plants started as contract shops, and some of the present contract shops will undoubtedly develop into future manufacturing plants.

An interesting method of co-operating with inventors

Fig. 2—An erecting floor at the plant of the Hartford Special Machinery Company. The work is grouped in lots, and run through on as near a production basis as possible if the contract calls for a number of units

and designing engineers is employed at the plant of the U. S. Tool Company. The company has fitted up a number of small rooms, partitioned off from the shop, each room being equipped with a bench, vise, desk, and drawing board. These rooms are rented on a weekly basis to inventors who desire to be on hand to watch their designs through the shop and to develop them themselves as machine work progresses. They are also permitted to go into the shop and operate the machines in order to make any part, provided that they obtain a work order and machine assignment from the foreman.

The organization of a contract shop is simple. Many of these are "one man shops" where the owner handles both the outside and the inside executive work, keeping contact with the customers and following the work through the shops. But this necessarily limits the size of the shop, and the first requirement for expansion is a capable shop foreman or superintendent, and a competent designer. The successful shops of any size meet these requirements. At the plant of the Hartford Special Machinery Company the president of the organization acts as the co-ordinating executive, the secretary of the company handling the office work, and the chief engineer being responsible for the design of the product. A superintendent has complete charge of the shop, with foremen over each department.

A Typical Small Shop

A typical small contract shop, but one doing a class of work beyond the range of the ordinary jobbing shop, is exemplified in the Boeger-Meyer Machine and Tool Company, where one of the partners handles the outside work and the office end of the business, while the other partner is responsible in general for the mechanical work of the shop, with a foreman in direct charge of the machine shop. The same condition, on a larger scale, exists at the plant of Frederick Hart and Company, Inc., but the number of foremen is increased, designers are provided, and there is a larger office staff. On paper there is no sales department in most of these contract shops, but actually some one member of the organization is usually very much occupied in contacts with customers, which constitutes in reality a high grade of sales work. Where the contract shop goes into a certain amount of production work, the sales of which are handled by the customer, no sales efforts are required for this part of the business, but some few shops produce regular products of their own, such as die sets, small tools, or mechanical appliances, that require advertising and special sales efforts. This is usually organized apart from the contract work.

Most manufacturing plants prefer to have an advance bid on the work that is to be given out by them, but obviously this is impossible in many cases of special machines and tools to be developed. Where the design is complete, or where the equipment has been built before, a competitive bid is always given, but even in such cases 5 or 10 per cent is ordinarily added to the bid to cover possible new experimental work or changes, since customers always object to "extras" on the bill. Various shops reported that a number of their old customers sent in their work regularly for billing on a cost-plus basis, but this only occurs where the shop has built up confidence over a period of years. In the case of new developments another method is to quote a tentative price with a provision for extras when the latter are approved in advance by the customer.

On the whole it is generally conceded that the customer does not like to place work on an hourly basis or on any method of cost-plus payment. While the garage-type of repair shop, or the jobbing shop in a small mill center, may be able to do a satisfactory business under such arrangements, the best classes of work in the more competitive industrial centers are not given out in this way. From the standpoint of the contract shop owner, moreover, the direct bid has the advantage that it does not limit his profits to a small regular margin if he can succeed in making his plant more efficient, and can produce the work more economically and in less time than his competitors.

Safety in Fixture Design

SAFETY should extend to all phases of shop work. It is not enough for machines to be supplied with guards for gears and revolving shafts but the tools used should also receive attention. A case in point is the design of fixtures.

Hinged lids should be so designed as to be easily lifted without danger of cutting or bruising the hands or fingers. Clamps should be capable of being operated without likelihood of skinning the knuckles or pinching the fingers. If bushings must be removed, ample and safe provision for so doing should be made.

These are simply suggestions for care in designing tools and fixtures that have been overlooked in too many cases. A little attention to such details will prevent many annoying, painful and unnecessary minor accidents.

Power Transmitted by Leather Belts
Discussion

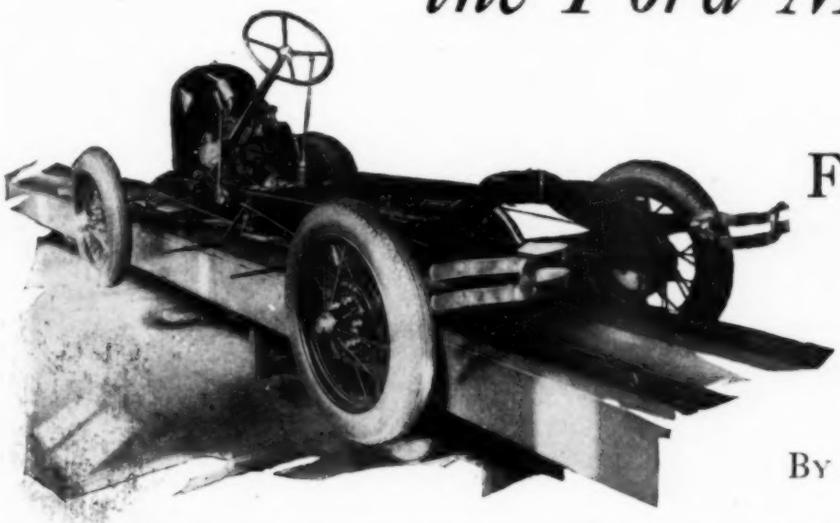
By Claude O. Streeter
Mechanical Engineer, Graton & Knight Company

WHILE I am in accord with conservatism, it seems apparent that the curves submitted by W. W. Nichols on page 347, Vol. 68, of the *American Machinist*, are ultra-conservative to such an extent that they would be detrimental to the leather belt due to the fact that a belt of so great a width would be required in order to transmit a given horsepower that its consideration would be out of all reason.

According to Mr. Nichols' chart, at 4,000 ft. per min., a 4-in. single belt would be transmitting 17 hp. This value should be 27 hp. An 8-in. single belt would be transmitting 34 hp. This value should be 54 hp. Dropping into the double chart, we find that at 4,000 ft. per min., a 4-in. double belt would be transmitting 28 hp. This value should be 43 hp. An 8-in. double belt would be transmitting 56 hp., while its value should be 86 hp. When we consider a 3-ply belt, we are again confronted with a similar situation due to the fact that a 4-in. 3-ply belt at 4,000 ft. per min. would be transmitting about 39 hp., which value should be 54 horsepower.

The values which I have quoted are generally considered reasonable, and in them no attempt is made to consider the overload capacity of the belt. Another thing about Mr. Nichols' chart which is wrong is the effect of centrifugal force at the various speeds. Using exactly the same formula as would be used for metal, these curves are correct, but as a matter of fact, centrifugal force is not a serious factor at speeds as low as 5,000 ft. per min., and the trend of the power curve is not downward in any instance at this point.

Equipment Makes Possible the Ford Model A



FABRICATING THE FRAME

By Fay Leone Faurote, M.E.

FIVE major sections and several minor parts make up the Ford Model A frame. The minor parts include the fender and running board brackets and other such tributary parts. The main sections are made of No. 9 U. S. S. gage hot-rolled open-hearth steel, pickled and "limed," which is held in thickness between 0.140 and 0.160 in. The steel has an elastic limit of 42,000 lb. per sq.in., minimum, and may be elongated in transverse direction in forming the parts. The Brinell hardness is held to 131, minimum. The fabrication of the frame furnishes a characteristic example of continuous-process manufacture. The tanks for washing, pickling, re-washing and "liming," together with the group of presses, large and small, that shape the parts; the assembly line, inspection, washing, drying, painting; and the conveyor system that traverse these units in the successive order given, are located in the north end of the new steel mill building at the Fordson plant.

The presses required for forming the major parts of the frame of the Ford Model A car are of enormous size, and weigh from 120 to 240 tons each. Presses for forming some of the minor parts and for piercing and riveting these frame parts together, are in fact numbered by the hundred

The steel is delivered from the Ford mill at the head of the process line by a service crane that traverses the shop at this point. The blanks are loaded into hanging, finger-like carriers, each carrier holding ten sheets of steel. Each batch is made up of both cross members and side members. There are two tanks and two conveyor systems running side by side, so that when the steel emerges from the neutralizing tanks, right and left members are in proper position to be delivered, over the oiling rolls, directly to the men in charge of the two large presses that perform the first blanking operations. The equipment is independently electrically driven and has a capacity of 2,000 frames for each shift of 8 hours.

The steel pickling tanks are of Ford design and construction and are 120 ft. long and 18 ft. 6 in. wide. The steel hot-water tank is 10 ft. x 14 ft. 8½ in. x 4 ft. 3¼ in. It is lead-lined and has a capacity of 4,750 gal. The acid tank is 56 ft. long, 12 ft. wide and 2 ft. 9 in. deep. It consists of two thick timber sheetings with a continuous lamination extending over the bottom, ends and sides of 2-in. mastic cement. It is securely bolted together with 1-in. Alcumite or aluminum-bronze acid-resisting bolts and is lined throughout with ¼-in. sheet lead. A 2-in. channel, forming a trough, runs entirely around the top of the tank and is kept filled with running water. The bottom edge of a Monel-metal gas-tight hood, covering all parts of the equipment emitting acid vapors, is immersed in this trough, making a water seal. The working capacity of this tank equals 12,600 gal. and it requires approximately 4¼ tons of sulphuric acid for each charge.

The steel cold-water tank is 11 ft. 3 in. x 4 ft. 3 in. x 12 ft. It is lead lined and holds 4,300 gal. The lime tank is 6 ft. 6 in. x 12 ft. x 4 ft. 3 in. and holds 2,400 gal. When the conveyor is running at a speed of 2 ft. 8 in. per min., the duration of immersion of the stock is twenty min. The number of plates in process at one time is 500, or approximately 7½ tons of steel.

When the material emerges from its final washing, the cross-member blanks go on to an underground conveyor that carries them farther down the line and brings them back to the surface in front of three rows of presses which they traverse in being formed from blanks to finished parts. Thus in looking down the frame de-

General view of the frame shop, showing the pickling and washing tanks and the large presses

partment, one sees first the two rows of pickling tanks, next a group made up of two rows of large Bliss, Toledo and Hamilton presses that form the side members, and in the far distance a final set of three rows of smaller Bliss, Hamilton, Toledo and Ferracute presses that form the cross members. To the right, as one looks down the process line, there is a balcony under which are rows of Ferracute presses for piercing holes and fabricating small parts and a sub assembly, while upstairs the main assembly line begins and is bordered by presses used for riveting side members, cross members, brackets, etc. This process line travels parallel with, but in the opposite direction to the initial one, and ends at the inspection table on the balcony where the frames are finally deposited for checking as to squareness, character of riveting and general workmanship.

When the frame-assembly begins, the various parts are put together with knurled rivets and are slung in a swiveled carrier suspended from an overhead trolley track. This form of suspension allows the frame to be rotated in any direction necessary for riveting and it remains in this sling until it reaches the inspection table, after which it is hung in a vertical position and passed on through the scrubbing, drying and painting corridors, again reversing its process-direction.

After the frame has received its final touching-up at the end of the painting operation, it crosses the shop, swinging in the open air, and finally reaches the open railway car in which it is packed for transport to the B building assembly line, in a dried condition. The exact manner in which the various operations are carried out is given in the order in which they occur. Typical operations on the left frame side member for a left-hand-control car are:

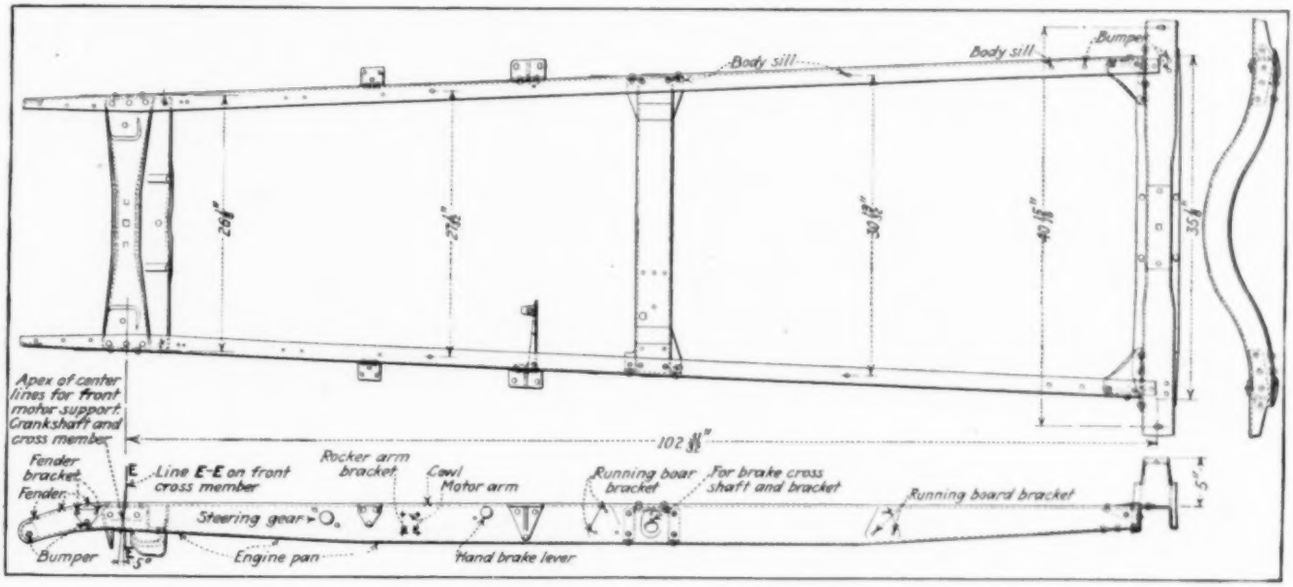
1. Pickling, consisting of washing in hot water, pickling in sulphuric acid, rinsing in cold water and neutralizing in lime water. Production: 400 per hour.

2. After being oiled, by passing over an oiling roller, it is blanked in a press having a capacity of 250 per hour. All holes are pierced at the rate of 240 members per hour, after which a press channel-forms the sides and front ends at the rate of 240 per hour.

3. A drill press then countersinks three holes and a press folds the rear-end lugs. These two operations are done at the rate of 300 per hour. In the meantime, similar operations have taken place on the companion side-member.

The presses used for these operations are of large size and vary in weight from 120 to 240 tons.

The front cross-member is blanked at the rate of 300 an hour, after which the locating holes are pierced. In the first operation after blanking, the front portion is drawn; in the second, the center pocket is formed; followed by a third and then by a restriking operation. After all holes have been pierced, except those in the flange, the member is restruck to bunk up the inside flange to a 5-deg. angle. The member is then trimmed and two $\frac{1}{2}\frac{7}{2}$-in. holes are pierced in the flange. The three



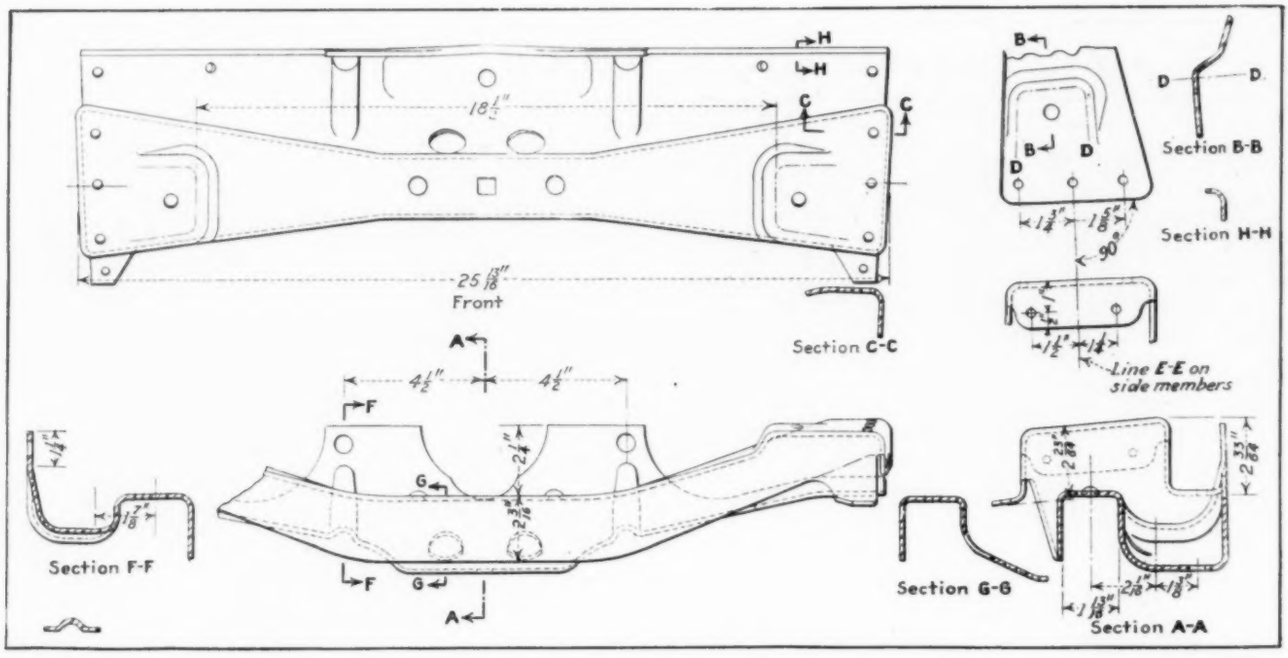
Frame assembly showing cross-members in place

Assembly Operations on the Frame

No.	Operations	Machines
1	Rivet side member to front cross member (2) Rivet in L. side	PA-4 Ferracute
2	Rivet side member to front cross member (2) Rivet in R. side	PA-4 Ferracute
3	Rivet side member to front cross member (3) Rivet in top L. H.	PA-4 Ferracute
4	Rivet side member to front cross member (3) Rivet in top R. H.	PA-4 Ferracute
5	Rivet side member to front cross member (1) Rivet in bottom rear L.H.	PA-4 Ferracute
6	Rivet side member to front cross member (1) Rivet in bottom rear R.H.	PA-4 Ferracute
7	Rivet side member to front cross member (1) rivet in bottom front L.H.	PA-4 Ferracute
8	Rivet side member to front cross member (1) Rivet in bottom front R.H.	PA-4 Ferracute
9	Rivet side member to center cross member (2) Rivet in top L. H.	PA-4 Ferracute
10	Rivet side member to center cross member (2) Rivet in top R. H.	PA-4 Ferracute
11	Rivet side member to center cross member (4) Rivet in side L. H.	PA-4 Ferracute
12	Rivet side member to center cross member (4) Rivet in side R. H.	PA-4 Ferracute
13	Rivet side member to center cross member (2) Rivet in bottom L. H.	PA-4 Ferracute
14	Rivet side member to center cross member (2) Rivet in bottom R. H.	PA-4 Ferracute
15	Rivet side member to rear cross member (1) Rivet in top L. H.	PA-4 Ferracute
16	Rivet side member to center cross member (2) Rivet in top R. H.	PA-4 Ferracute
17	Rivet rear corner upper bracket to rear cross member L. H. (2) Rivet in side	PA-4 Ferracute
18	Rivet rear corner bracket upper to rear cross member R. H. (2) Rivet in side	PA-4 Ferracute
19	Rivet side member and rear cross member to rear corner bracket, upper. (1) Rivet L. H.	PA-4 Ferracute
20	Rivet side member and rear cross member to rear corner bracket, upper. (1) Rivet R. H.	PA-4 Ferracute
21	Rivet side member to rear cross member (1) rivet in end L. H.	PA-4 Ferracute
22	Rivet side member to rear cross member (1) Rivet in end R. H.	PA-4 Ferracute
23	Rivet rear cross member to rear corner bracket lower, (2) Rivet in bottom L. H.	PA-4 Ferracute
24	Rivet rear cross member to rear corner bracket lower, (2) Rivet bottom R. H.	PA-4 Ferracute
	Inspect	.....
	Wash	Washer
	Dry	Dryer
	Paint	Sprayer

Sub-Assembly Operations on Side Frame

No.	Operations	Machines
1 and 2	Weld front bumper plate to side member R. H.	(3) Federal Welder
	Weld front bumper plate to side member L. H.	R. and L. H. on (3) Welder
3 and 4	Rivet brake rod spring bracket front to side member R. H. (2) Rivet	PA-4 Ferracute
	Rivet brake rod spring bracket front to side member L. H. (2) Rivet	PA-4 Ferracute
5 and 6	Rivet rear corner bracket upper to side member R. H. (1) Rivet in side	PA-4 Ferracute
	Rivet rear corner bracket lower to side member L. H. (1) Rivet in side	PA-4 Ferracute
7 and 8	Rivet rear top corner bracket to side member R. H. (2) Rivet	PA-4 Ferracute
	Rivet in top	
	Rivet rear corner bracket lower to side member L. H. (2) Rivet in top	PA-4 Ferracute
9 and 10	Rivet hood shelf support bracket to side member R. H. (3) Rivet	PA-4 Ferracute
	Rivet hood shelf support bracket to side member L. H. (3) Rivet	PA-4 Ferracute
11 and 12	Rivet body bracket to side member R. H. (3) Rivet	PA-4 Ferracute
	Rivet body bracket to side member L. H. (3) Rivet	PA-4 Ferracute
13	Ream holes to fit steering quadrant	20 in. Cincinnati
14	To conveyor and washer	.....
	Rivet front cross member, center cross member and rear cross member to side member. Hold parts in place with 42 Rivets and hand on conveyor	



Details of the front cross-member

final operations take care of piercing four $\frac{3}{16}$- and two $\frac{1}{8}$-in. holes, after which it goes to the washer and to assembly by means of a conveyor.

After the center cross-member has been blanked it is given its first form and is then restruck. In the fourth operation, all holes are pierced in the top. Piercing is also done in the fifth, sixth, seventh and eighth operations, the first putting four $\frac{1}{64}\frac{1}{4}$-in. holes in the right end; the sixth, four $\frac{1}{64}\frac{1}{4}$-in. holes in the left end; and the seventh piercing one $\frac{3}{64}\frac{1}{4}$-in. hole, one $\frac{3}{4}$-in. hole and one hole in the rear side. The eighth and final operation is the piercing of two 1-in. holes in the front side. Then it goes to the washer and to assembly by conveyor.

After the rear cross-member has been blanked, the second operation is piercing one hole; the third is a drawing operation, followed by a restrike, after which the top and sides are pierced and two riveting operations are performed. Then it goes to the washer and to assembly by conveyor.

The accompanying tables show the list of assembly operations on the frame and the sub-assembly operations on each of the side frames.

What Are the Best Methods of Lubrication?

LUBRICATION is not simply a matter of oil holes and oil although many machine builders seem to consider their job done if there is an oil hole leading to every bearing. Quantity and quality of lubrication play an important part in the satisfactory performance of any machine.

In some printing machinery recently examined, the oil passages varied from plain $\frac{1}{8}$-in. drilled holes, exposed to dirt and with no semblance to protection, to a few oil cups and ball oilers. In between these extremes were countersunk oil holes and small reservoirs to be packed with waste and saturated with oil. Some of the bearings oiled through the plain $\frac{1}{8}$-in. holes were apparently just as important as some of those provided with the waste oil-filters, and the discrimination was not easy to explain.

The necessity for having clean oil can hardly be overestimated and it is interesting to note that oil filters are becoming standard equipment on some machine tools as well as on motors. Some motor service men contend that unless efficient filters are provided, forced feed lubrication is more apt to cut the bearings than is gravity or splash feed. Grit forced into the bearings with the oil cuts them badly at times, whereas it will settle to the bottom in a splash or gravity system and do little damage. This of course assumes that the oil reservoir has a settling chamber.

In internal combustion motor practice, the use of force-feed oiling is now almost universal. There are, however, a few engineers who cling to gravity oiling for the main bearings and use splash oiling for the rods. These engines are fitted with less clearance than are those having force-feed bearings, even though some of them run at high speed. They seem to have no more bearing trouble than those having drilled crankshafts.

Lubrication is especially important in aircraft engines. Too much oil may be as bad as too little. The temperature of the oil is also important as well as the kind of oil. One foreign aviation engine that was designed to use castor oil, gave trouble with mineral oil until the capacity of the oil pump was increased. Too much oil, on the other hand, fouls the spark plugs and may carbon up the piston rings. Care must also be taken to have the scavenging oil-pump force all of the return oil to the filter before the oil feed-pump starts it on its rounds again. A leak between the two pump chambers must be guarded against, as it may simply by-pass the oil and deliver hot and dirty oil to the bearings, or none at all.

Lubrication problems are different in various machines, but they exist in them all and are becoming more important as we demand better service of the machines.

Automobiles use 50 per cent of the plate glass, 63 per cent of the upholstery leather, 25 per cent of the aluminum, 28 per cent of the nickel, and 80 per cent of the gasoline produced in the United States.

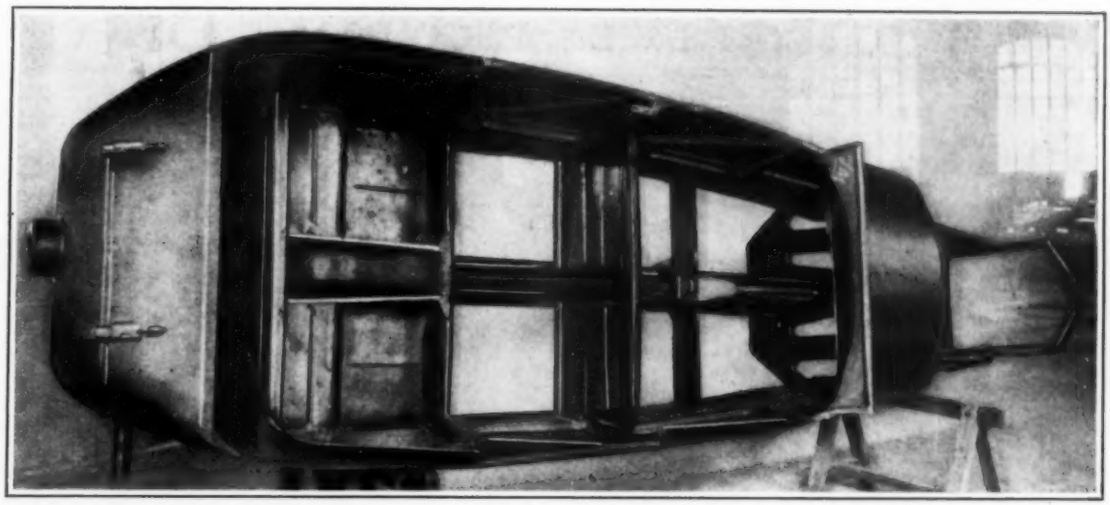


Fig. 1—A completed body on its side so as to show the unit construction of the body and frame

Automobile Body and Frame Combined in a Single Unit

By J. A. Lucas

The unusual construction of the Lancia body, which involves reinforcements and a tubular sub-frame for the engine, combines a number of original features and methods

UNLIKE the general construction of automobiles where the chassis is built on which to mount the body, the Lancia design combines them both in one unit. Instead of a deep channel frame with cross members, the lower part of the body itself is so constructed as to form the frame, while the splash guard in front, the foot board, the back of the front seat and the floor construction of the rear compartment, form the cross bracing of what takes the place of the frame.

A general idea of the construction can be had from Fig. 1 which shows a completed body that it must be remembered also includes the frame. As will be seen, the body is one unit from the radiator shell at the front to the spare wheel carrier at the rear and includes rear-axle housings, which are shown in place. Details of the longitudinal bracing that takes the place of the frame will be shown later. This view, however, shows the way in which the rear flooring, the back of the front seat and the foot board form substantial cross-braces in addition to the small cross-brace in front of the forward seat.

In Fig. 2 may be seen the underside of the front end with the two tubes that form a sub-frame, that supports the engine and the transmission. These tubes are welded at each end, the rear ends being supported by formed sheet-metal brackets riveted to the steel foot board. The tubes are carefully ground to size and are located in their correct positions by a fixture that holds them while they are being welded at each end. The importance of maintaining correct alignment of the engine and driving units necessitates great care in this part of the work, one of the last operations on the engine being to bore the supporting arms where they rest on these tubes. The depth of that portion of the frame forming the sill can be seen at *A*, while the center reinforcement can be seen at *B*. The malleable casting shown at *C* is riveted to the side for attaching the steering mechanism, which is also fastened to the tube on that side.

Starting at the beginning of the sheet metal work, we see in Fig. 3 a completed side with the door and other openings cut out. The sheet forming the side of the body is about $\frac{1}{10}$-in. thick. The front is at the left. The sheets are cut with rotary shears as in Fig. 4, the men becoming very expert in following the outlines and handling the sheets, which they do more rapidly than might be expected.

One of the first operations is to form the back end of the sheet on the concave block shown in Fig. 5. Here the sheet is clamped to the form by the curved channel, as at *A*, utilizing projections cast on the forming block for that purpose. The other end is held in position by the hook *B*. With the sheet clamped on the block, it is flogged into the desired shape by means of a heavy mallet, working it to the curve of the cast-iron form on which it rests. Needless to say, this work requires con-

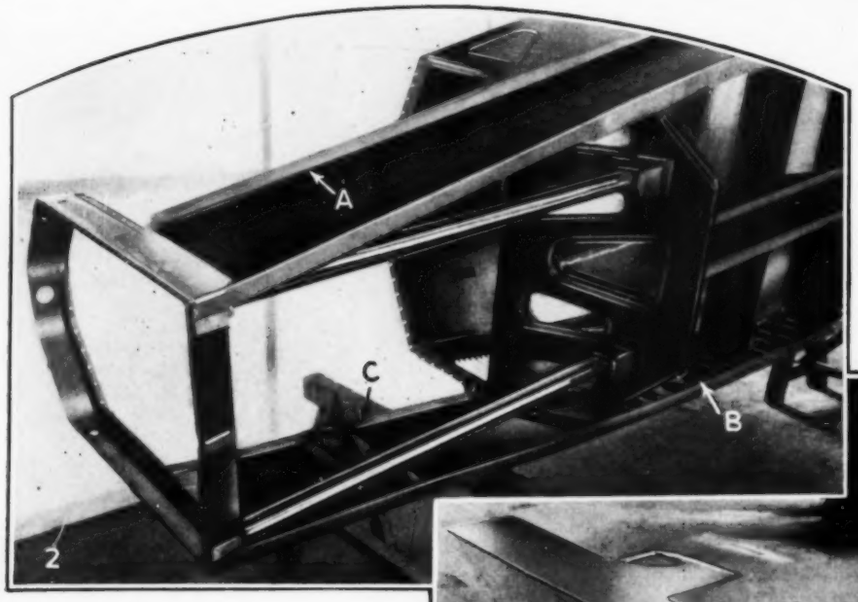


Fig. 2 — Front end of frame showing the tubes that are welded in place and form the bearers or sub-frame for the engine and transmission unit. These members act as stiffeners in addition to supporting the engine unit

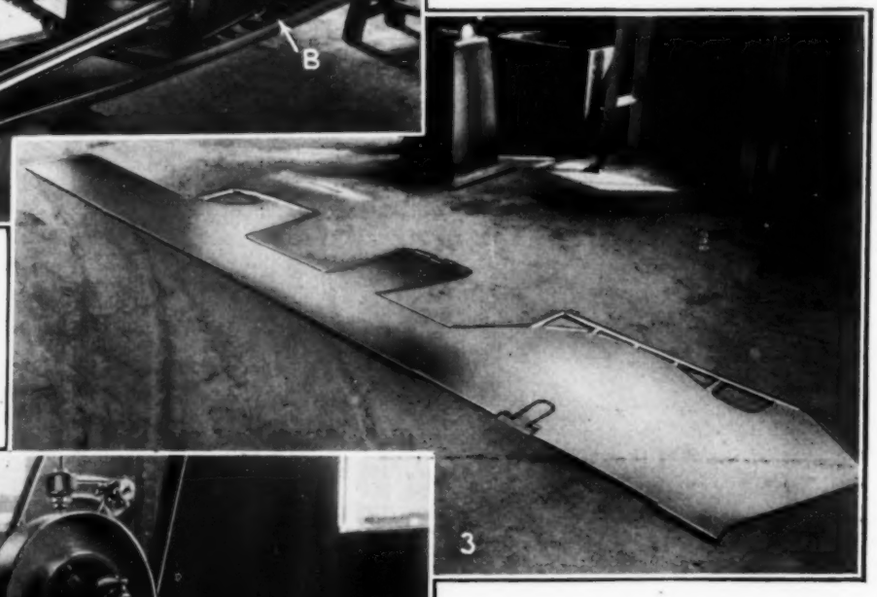


Fig. 3 — One of the side sheets after being cut out and ready for forming. The sheets are laid out by pattern or templet, and the cutting is done by both rotary shears and chisels

Fig. 4—Cutting out a door opening with the rotary shear. The operators become very skillful in following the layout and handle the work rapidly

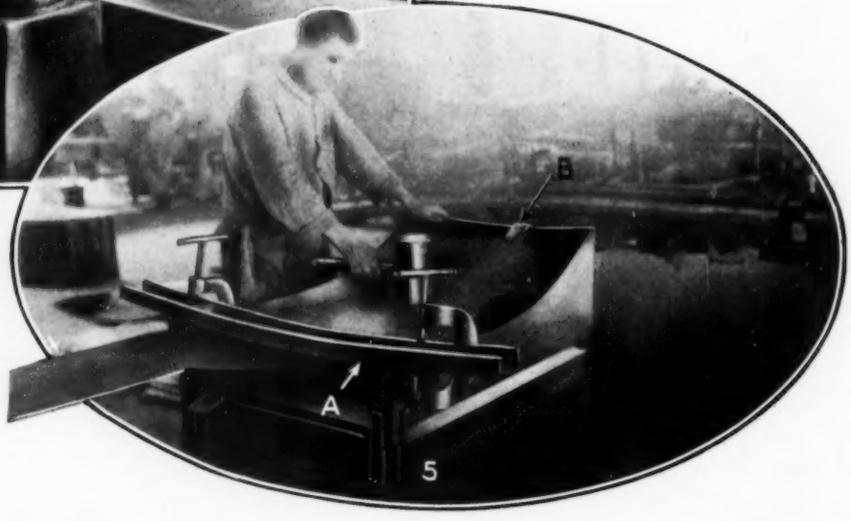


Fig. 5—Form in which the sheet is concaved before going to the long form shown in Fig. 6. The curved clamp conforms with the contour of the form, or die, and the sheet is shaped by flogging with the large mallet shown

Fig. 6—One of the iron forms over which the side sheets are clamped and the edges turned over while the sheet itself is made to conform to the desired contour.

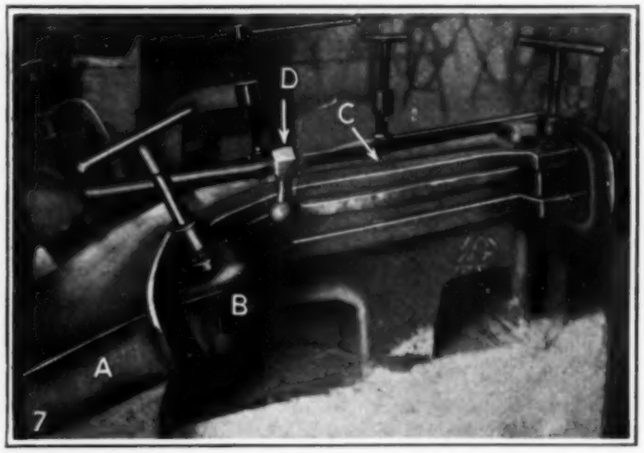


Fig. 7—A detail of the forming operation showing the cast-iron form underneath, the steel inserts which receive the wear, the way in which the metal is held around the openings to be formed, and the type of hammer used in drawing the sheet over the edge

siderable skill, as those who are familiar with the forming of sheet metal are well aware.

After the rear end has been curved, the sheet is taken to the large form shown in Fig. 6 where it is clamped at frequent intervals, using C-clamps to hold the upper forms, or straps, in place. The edges are turned down, using specially shaped hammers and the sheet is formed at all points before releasing it from the clamps. A detail of part of the form is shown in Fig. 7 which indicates the cast-iron base *A;* the steel inserts *B;* the long clamp and guard for holding down at *C;* and one of the forming hammers at *D*. The guard *C* effectively prevents the sheet from being marred by the hammer, as it presents only the portion that is to be turned over to the action of the hammer.

The method of securing sufficient stiffness in the lower part of the body is worthy of note. The stiffening of the central portion of the body is by the use of an auxiliary cupped-plate as shown at *A*, Fig. 8, the stiffener being welded to the body along its edge and also at the bottom of each cup. With the stiffening plate held in position as shown, the edges and three spots at the bottom of each cup are welded to the outside sheet. These welds show plainly in Fig. 9 and also in Fig. 10. Fig. 9 gives a good idea of the appearance of the side of the body at this stage, as it shows the different reinforcements, such as around the opening for the axle housing at *A*, the angles welded on at *B* to support various portions and the small angular plate *C* containing the rear louver.

Some of these welds are shown in Fig. 10, but in addition there is the substantial foot plate *A* and the longitudinal reinforcement *B*, consisting of a deep, inverted U-section that houses the propeller shaft almost directly behind the transmission. This U-shaped housing is cut away at *C* in order to accommodate the control shaft between the shift lever and the transmission case which is ahead of the foot plate. At *D* an auxiliary cross plate is shown.

Some of the smaller parts are stamped on presses, but this is only possible where there are several uses for the same part or where the dies are inexpensive. For a production of 3,000 cars a year does not permit the expenditure of large amounts for equipment if their cost is to be amortized within a reasonable time.

The radiator shell is riveted to the side sheets, while the body is mounted on the substantial fixture shown in Fig. 11. This arrangement permits the radiator shell to

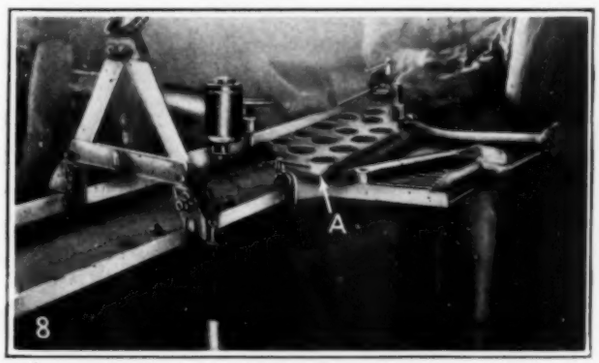


Fig. 8—Spot welding a reinforcement at the front end of the frame. This reinforcement has a series of cups, which are spot welded to the frame itself at three points in each cup. This adds greatly to the stiffness of the frame.

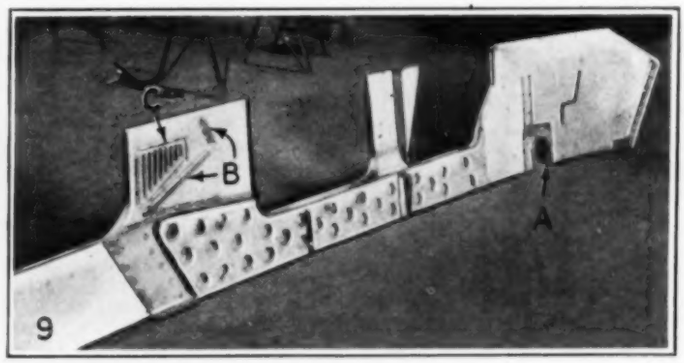


Fig. 9—One of the sides of a body showing the reinforcement held in position, and also various angles attached at the desired point. The small angular plate containing the rear louvers is also welded onto the sheet

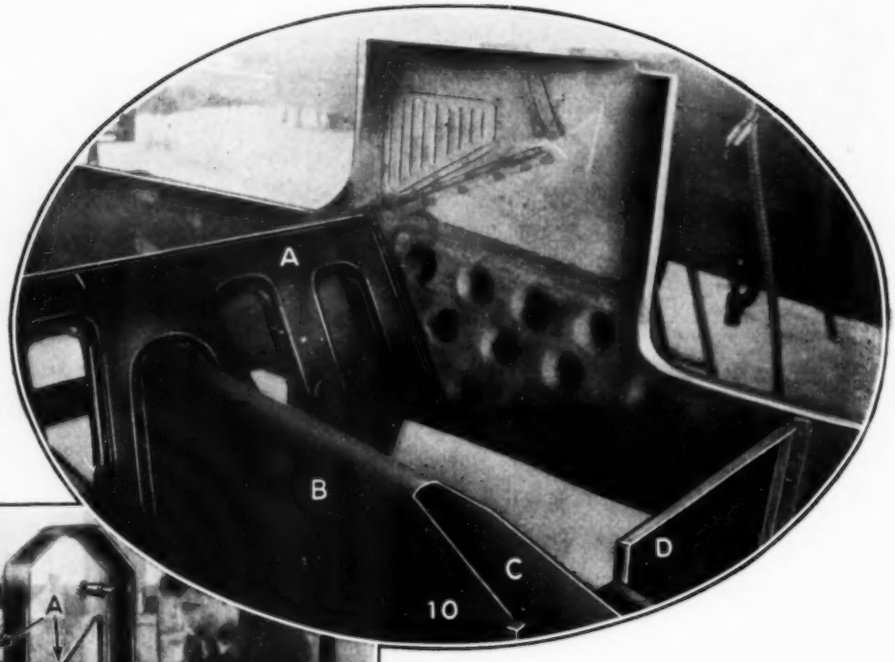


Fig. 10—A section near the front which shows the spot welding at the bottom of the cups in the reinforcing sheet and also the substantial footboard and longitudinal brace. This combination bracing makes a very stiff body

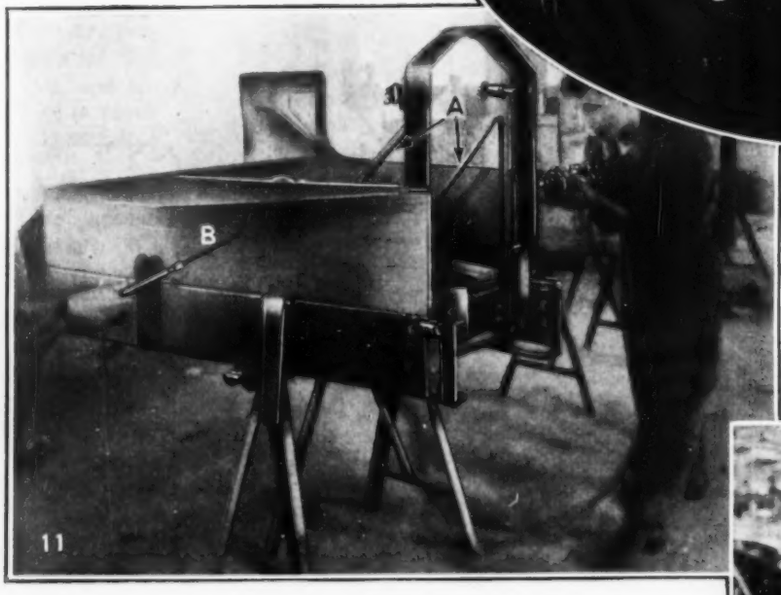


Fig. 11—Building up the front end by both riveting and welding. The body is assembled on the substantial framework shown, and the radiator shell is held in its proper position while being drilled and riveted

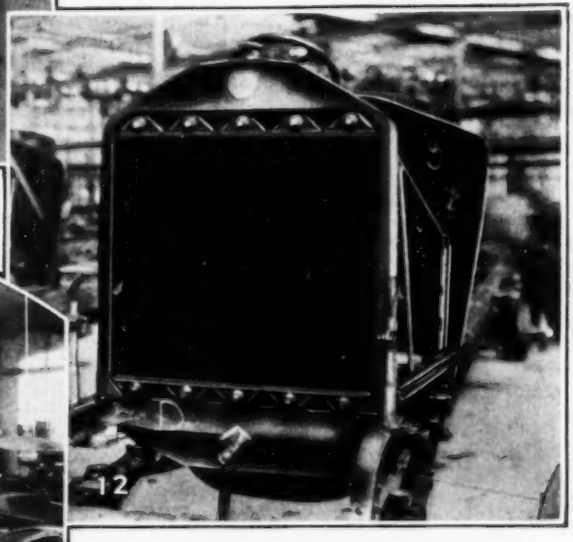


Fig. 12—Radiator cores assembled in the shell, or frame. This sectional construction is particularly convenient when repairs are necessary

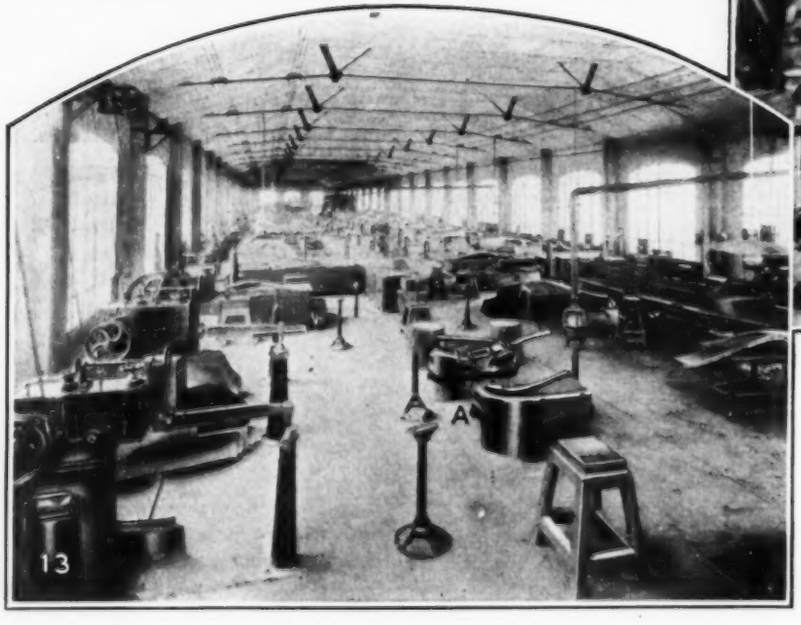


Fig. 13 — A general view of the shop in which the fenders and similar parts are formed. The small power hammers at the left aid in securing the desired shapes, but much of the forming is done by hand in the large forms shown on the floor

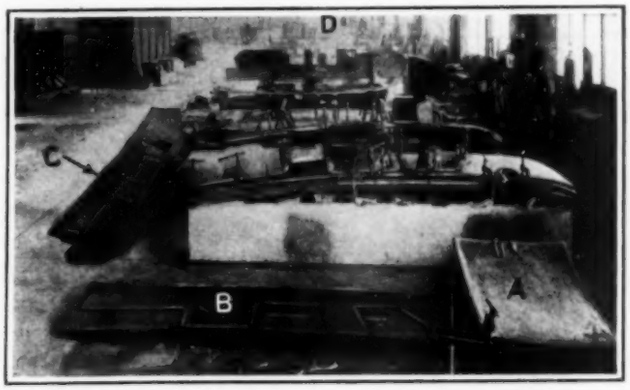


Fig. 14 — The dies, or forms, over which the bodies are shaped, as well as some of the sheets themselves in various stages of completion

be clamped in position and the holes to be drilled through the front end of the body and the shell while in this position. The method of aligning the radiator shell is to position it by means of the forms shown at *A* so as to insure its being square with the sill of the body. At the same time some of the small outside welding is done as at *B*, while the body is in a convenient position.

The radiator cores fit inside the shell and are bolted to it. They are made in sections as shown in Fig. 12. The cowl is welded in place across the top and acts as a cross plate at the top of the front portion. The result of this construction is to make a body that is very rigid and free from squeaks.

Two views of the sheet-metal shop are shown in Figs. 13 and 14, and give a good general idea of the equipment used. The light trip hammers at the left in Fig. 13, sometimes called "bumping" hammers, are of considerable assistance in forming certain desired shapes on the fenders and other parts. Most of this shaping, however, is done on the forms at *A*, where the skill of the workman plays an important part. This view shows the excellent lighting of the shop and the ample room provided for each operation. Fig. 14 gives a general view of larger work, including the forms on which the sides of the bodies are shaped. The large forms can be modified so as to handle more than one type of body. This view shows the preliminary form at *A*, the sheets as they come from the trimming machines at *B*, and as they appear after forming and before further work has been done on them at *C*. At *D* the sides of the bodies are being placed on the vertical forms where they will be assembled and welded together into a complete body unit.

Workmen become greatly skilled in hammering, forming and welding shaped metal, to secure both the proper shape and a smooth surface for finishing. The parts are so carefully handled that but little filing of the exposed welded seams is necessary before the first filler coat is applied to the metal.

Different Incentives for Different Classes of Executives

By Howard Coonley
President, Walworth Company

OUR company has had incentive plans for executives under experimentation for fifteen years, during which period one plan at a time might be tried for a year or so. Finally we have reached the point where no plans for executives in different positions are the same. For the purposes of this discussion I am going to speak of three only.

The first is what we might call the compensation that goes to the general officials of the company. I might explain that the Walworth Company manufactures and sells direct to the jobber and to the large consumer, but also sells through its own branches to the ultimate purchaser. Each year that we can earn above that 10 per cent on the common stock, we feel that a portion properly belongs to those executives in these varied activities who have played a major part in the success of the company. The directors each year, so far, have decided to set apart for this purpose 10 per cent of what we now call our "Extra Profits." The point I want to bring out in that first form of bonus is that it primarily depends entirely on the success of the company as a whole.

The second form of bonus is based entirely on the record of the unit itself, and today that form is used only in the case of our factories. We have put our manufacturing plants on a single-unit basis because we feel that the record of each plant is largely dependent on the efficiency of its own organization. These men have no influence on the other activities of the company. Therefore, they can be best recompensed by a share in the profits over which they have a very definite control.

This second type of bonus depends, first of all, entirely on the showing of some individual unit of the company; secondly, there are varying bases of computation of bonuses for our different production units which depend on the character of their equipment and the competitiveness of their product.

The third form of extra compensation is primarily used in the case of our branch houses. At one time we figured the compensation of the branch manager and his immediate subordinates entirely on the showing of that individual unit. We determined to discard that form of bonus payment and divide the managers' bonuses, as equally as we could, between the showing of the company as a whole and of his particular branch, since we found that the interests of the two clashed at times.

Since our branches handled not only Walworth material but the products of other manufacturers, which we call "resale material," and since we were primarily interested in the distribution of our own products, we decided to minimize the influence of resale material on the branch's bonus. So we have rather an intricate but apparently satisfactory plan whereby the bonus of these branch managers is taken approximately 50 per cent from the showing of their own branch and 50 per cent from the showing of the company as a whole.

Abstract of a speech presented before the American Management Association in New York.

Discouraging Cancellations

TWO men sat across from each other at a round table in a sunny corner of the Union Club grill. Over coffee and cigars they were considering a pile of papers that lay between them. One, of course, was William Holland, unofficial and extraordinary consultant. The other was an old friend, Arthur Knowles, president of the town's largest metal stamping plant. They had worked together as apprentices but had been in different cities for several years.

"Well, Bill," said Knowles, "I guess I've shown you that there was something on my mind more than a desire to talk over old times, pleasant as that has been. How do you like that last one?"

"I don't like it, Art, and that's a fact," observed Holland as he laid down the letter he had been reading. "Why the dickens should this company, which is ten times as big as yours, ask you to hold the bag because they misjudged the sentiment of their customers and planned a production twice as large as they could sell? What have you done about it?"

"Nothing—yet. If I let my feelings get the better of my business judgment I'd threaten suit, and stand ready to make good the threat. But that would be short-sighted policy, I'm sure, because that outfit buys more stampings from me than any other two customers. And, as a rule, they are fairly decent people to do business with."

"Mm-hm," agreed Holland, "and you can bet your last cent you'd never get another order from them if you got arbitrary."

"I know it. But what am I going to do to get out of this hole? Their order was for 500,000 pieces and I naturally figured my costs on a spread of the die cost over the whole lot. They have taken 200,000 and cancelled the rest. And I've got three-fifths of the die cost yet to absorb."

"Will they take the balance later?"

"I think not. My hunch is that there's a design change in the assembly that takes this part and that the whole thing is obsolete."

"Have you billed them for the ones they've accepted?"

"Not yet."

"That's good," said Holland, "don't until we've had a chance to do a little more figuring. Why not handle this the way the advertising and insurance people do? If you don't take the full amount contracted for they charge you a short rate for what you have used. It's fair, businesslike and usually doesn't make any fuss."

"Perhaps I could, Bill, perhaps I could. Just as when you get rid of an automobile, or a house, you get a short-rate adjustment from the insurance company. The big difference is that you pay for insurance in advance, and for stampings after they are delivered. And not so soon after, either, sometimes."

"Well," returned Holland, "so long as you haven't billed them, why not add in the unexpended balance of the die cost and the interest on the die investment and any other similar items that ought to be included, such as material cancellation charges? Send them a bill figured on that basis and explain how you arrived at it. I believe you'll get away with it."

"I'm going to try it, anyway. Send me your bill when you get home. If this works out, I'll still be indebted to you after I've paid it."

Executives are invited to discuss the problem involved in the foregoing case. Accepted contributions will be paid for.

Discussion

About Wage Incentives

As ordinarily described, all forms of wage incentives look like a mighty good thing, for on the face of them it looks as though neither management nor men can lose by them—in fact, the natural expectation is that both will gain. This is true, providing the work is highly organized

production work on a standardized product. If the work is variable, it is a highly speculative undertaking to install such a system without detailed investigation. If the shop handles both standardized products and special jobs, there is bound to be trouble, for if the special job men are kept on straight wages, they will resent it every time a straight production man beats them out on a week's wage. They are probably justified, because the best men are usually reserved for special work. If an attempt is made to put the special work on a premium system, there is always the problem of haggling and arguing about the time set for an experimental or special job, with its lost time and expense for especially competent rate setters.

If the wage incentive idea has been successfully tried out in an industry, and it can be installed under the supervision of a competent executive who has had practical experience with its details as well as theories, I believe it a mutually beneficial undertaking for all concerned. Under such circumstances, I heartily favor the Halsey premium plan, because it definitely defines the expectation of gain for each party for all time. Unlike the piece work system, wherein there is a temptation for each side to feel the other's gain is too great, it definitely establishes itself as a mutually beneficial arrangement from its first inception. —ROLAND GIBSON.

How Determine Allowance for Parts Ordered Omitted From a Machine?

The starting-point in calculating allowances for parts omitted from a machine should be the net price. The regular net price which an agent pays the factory for a standard machine is presumably the lowest price that will reimburse the factory for its manufacturing and marketing expense and leave a satisfactory profit.

The only difference in any of these items of expense, due to the omission of a part from a standard machine, is a reduction in the manufacturing expense by an amount equal to the actual factory cost of the omitted part, in material, labor and overhead. Accordingly, the highest price the manufacturer can ask the agent is the regular net, less the factory cost of the omitted part.

Looking at it in another way, what the agent really does is to buy a standard machine at the regular net price and then sell a certain part of the machine back to the factory. This part is worth no more to the factory than its cost of manufacture, which leads us to the same answer as before, that the agent should pay his regular net price, less the factory cost of the part not wanted.

What if the manufacturer is unwilling to have his agent know the actual cost of the crankshaft? If he takes this attitude, then he should allow the agent to deduct from the net price the list price of the shaft less his longest discount, in this case the rate of discount used on a complete machine. The resulting net price will be the same as if the list price of the part were deducted from the list for the machine and regular discounts then taken.

As a matter of practice we have always held that a machine with so important a part as a crankshaft omitted was a special machine. In such a case we usually quote a special flat net price and try to avoid being drawn into any involved mathematical discussions.—C. S. HAZARD.

Allowances for Old Machines

There is only one stand a real business executive can take on the above question and that is to buy the Stanley machines, as they will produce work of required quality and at the lowest cost based on his experience with the machines at present in his plant.

By purchasing the other machines a saving on the initial investment is certainly made but a loss in production and consequent higher costs would be recorded every day the competitor's machines were in use. The longer these machines lasted the greater would be the loss sustained. This would make it difficult for the Bradbury Gear Works to meet costs or sales prices of a competitor using Stanley machines.

The old Stanley machines, being of a reliable make, will always find a ready market with any good dealer in used machinery.

—A. CADDIE.

How Can I Regain "Dull Time" Overhead?

Frank Whittaker has so thoroughly covered the subject in his letter to Mr. Holland that I hesitate to add further comment. I think he is absolutely right in his analysis and application of his fact finding. However, here is a further thought on the subject.

The engineer, in designing any structure, uses what is known as a factor of safety. It is a multiplying unit by which he increases his analyzed facts and findings to cover unknown contingencies, so that his structure will still be safe when it meets unexpected and unforeseeable conditions. Sometimes it is laughingly referred to as a "factor of ignorance," but under whatever name it is given it is a safety valve against failure.

Now, having so thoroughly determined his facts, why cannot Mr. Whittaker apply such a factor to his selling price, making it, however, additive and subtractive rather than multiplying? When business is good, the market price in general

for similar products high, and selling effort easy, it can be an additive factor of so much on his selling price. When times are dull, and business hard to get, with its consequently increased overhead, it can be a subtractive factor. By carefully keeping his balance of "pluses" through good times, he can know definitely what his "minuses" can total during slack times. Accurately kept in a business-like manner, it is a logical procedure and is not to be confused with any unethical practices such as charging what the traffic will bear or price cutting. It is just a small cumulative factor applied directly to his costs founded on facts and acts as a sort of dull-time insurance reserve without in any way affecting the quality of his product. To make it fully operative, the money accumulated during boom business periods should not be expended as profits, but actually maintained in a reserve fund. —J. M. STEESE.

What Is Overhead?

What is overhead? To the average foreman it represents a large amount of money spent for clerks, superintendents, managers and other unnecessary evils, a portion of which is saddled on his department. It is one of the few reasons for the cost accountant's existence, and the plant manager sees it as some sort of a monster continually increasing in size.

Figuring burden on a productive labor basis is only one method of absorbing it. The basis for figuring overhead depends largely on the nature of the industry and the fact that labor costs are decreasing is not in itself a valid reason for changing the method of figuring burden. The percentage of increase or decrease does not mean anything as there is no direct relation between overhead and labor.

Executives must face the fact that if they are to keep alive to new methods and in line with our present era of progress, overhead is bound to hit the sky, but on the other hand there will be an offsetting saving in labor or a better product will be the result.

As our own plant manager recently expressed it, "I wish my entire plant was burden so that I could come to my office in the morning, press a button and start the factory working and turning out the product without the aid of human hands. Looking back over the progress of the past 25 or 30 years, such a feat may not be impossible in the future." —E. F. WEIMAR.

Using the cost of labor as a base upon which to calculate overhead is an accurate method of determining the cost of a product if the machine costs are fairly constant for all products upon which the same overhead percentage is applied. In such case it is very simple to calculate the cost although it gives a very poor insight into the relative importance of the factors included in the overhead percentage.

Such a method is very inaccurate if the machine costs for producing different products vary greatly. A satisfactory base upon which to apply the overhead percentage in this case can be obtained by adding the labor cost to the machine cost. The machine cost is obtained by multiplying the machine-hour rate by the number of hours which the machine was used.

A machine hour rate should include all expenses that are directly traceable to the machine such as rent on space occupied, maintenance and depreciation. The depreciation as included in the machine-hour rate is a rate which, when accumulated during the profitable life of the machine and added to its salvage value, is estimated to be large enough to purchase a new machine.

Such a method of figuring the cost of products involves more clerical cost than the old method of using the labor cost as the base but it is very accurate and, what is ofttimes more important, it indicates the best means for reducing the cost of production. One very large, successful manufacturer claims that the only real justification for cost analysis is defeated if production costs are not lowered as a result.

—W. L. ROMICK.

Keeping Machines Running

Mr. Holland's plans for keeping machines running are certainly all very good, but it strikes me that they are all based on some form of group incentive. I have in mind a plan that depends for its success purely on individual incentive.

This plan has as its basis the establishment of a sort of budget of the amount of time it is reasonable to expect a machine to be down in the course of a year of careful operation. Each time the machine is down that time is charged against the total for that machine and operator. If, at the end of the year, the machine has been down less than the allotted time, the operator is paid for the hours saved at what is the profit of the machine per hour. Any minor adjustments or repairs which can be made without turning on the power may be had by the operator on request —the work being done by night repair men engaged for that particular purpose, and without charge against tie-up time.

In order to discourage too fussy and unnecessary replacement of parts by request of the operators, repair parts also may be budgeted. When the allowed amount is reached, any excess is charged off the saving in lay-up time made by the operator at the end of the year, and he is paid only the difference.

Such a scheme places the operator in a position as proprietor of a one-man machine shop—he can earn himself a fine Christmas bonus in this way, dependent entirely upon his own initiative. The ambitious man will usually be found early on the job, carefully oiling and checking over the various parts of his machine before starting the day's run.

—JOSEPH LANDHERR.

Details of Jigs and Fixtures

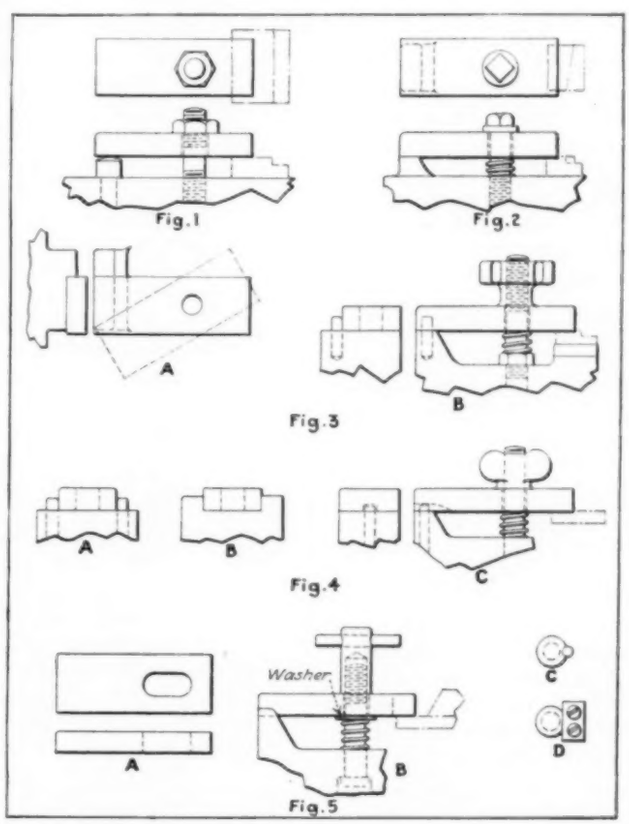
Design of Clamps

By J. A. POTTER

Clamps constitute one of the most important details of jig and fixture design, and an understanding of a few basic principles will make the layout easier for the designer

AN ECONOMICAL method of clamping that can be adopted for temporary tools, or for tools that are not required for large production, is illustrated in Fig. 1. A stud, nut and shoulder pin, acting as a seat for the tail end of the clamp, are the accessories. This clamp will fall down at the nose and swing. This clamp is not a satisfactory arrangement for permanent work, as the stud is likely to loosen, and the clamp will have to be lifted when loading the jig or fixture. A better arrangement is shown in Fig. 2. The clamp is held up by a spring, and a milled lug is used at the tail to form a seat. The capscrew is then used for holding down the clamp. This clamp will swing, but has no stop to bring it to a normal position, and it has the fault that the threads of the capscrew are likely to wear.

Clamps that are intended to swing can be located as shown in Fig. 3. The lug or pin should always be on the left side of the tail when a right-hand binding screw is used, so that the friction in binding the clamp will swing it to its normal position. At *A* is shown a stud locked by a nut, and a hand knob for tightening the clamp. Three methods for holding the tail in a normal position are illustrated in Fig. 4. At *B* the clamp is also shown with a wing nut for binding, making a neat arrangement for small clamps. The plain clamp can be made to slide back if an elongated slot is used at the binding pin hole. This is illustrated at *A*, Fig. 5. Clamps that slide should have a washer on top of the spring to keep the end of the spring out of the slot. At *B* is shown the binding screw with a head, and driven in from the under side of the jig. This type of binding screw is easily removed when the thread wears, and will never pull out. If the section through which it is driven is short, it must be doweled in order to keep it from turning. This is shown at *C*, and a flat end to accomplish the same purpose is shown at *D*.



Figs. 1-2—Simple forms of clamps. Fig. 3—Stop for swinging clamp. Figs. 4-5—Guides for sliding clamps

Outside of the cam operating clamps, the hand screw, hand knob and wing nut form the conventional methods by which clamps are tightened. These can be operated much faster than clamps that have a nut that must be tightened by a wrench. If production is not large and it is desirable to keep a fixture small, the nut can be used to advantage, but where several clamps are used on the fixture, all nuts should be of the same size so that the operator will not have to put down one wrench and pick up another. Where many jigs and fixtures are made, clamps can be made in quantities and kept in stock. It will be found that they can be worked over into several types at considerable saving in costs.

At *A*, Fig. 6, the plain clamp is shown with a small cut on the under side to relieve the toe. This is easier and cheaper than the method of making the cut the full length of the clamp, as shown at *B*. For stock clamps, the toe, as shown at *C*, can be readily made over into the rounded toe shown at *D*, or it can be relieved at the center, making a two-point bearing as shown at *E*. At *F* and *G*, other styles of ends are shown worked on the same type of clamp. The swing clamp shown in Fig. 7 will be found very useful in jig and fixtures used on finished surfaces. This clamp is usually located to bind at a fixed distance, and is limited in regard to up and down movement of the toe. The advantage is that it will swing out of the way and give room to load or unload the part. A spring is not needed with this type of clamp. The goose-neck clamp shown in Fig. 8 is used on lathe and grinding fixtures where it is necessary to protect the operator from the danger of protruding handles. It is also used

The thirteenth article. The fourteenth will appear in an early issue.

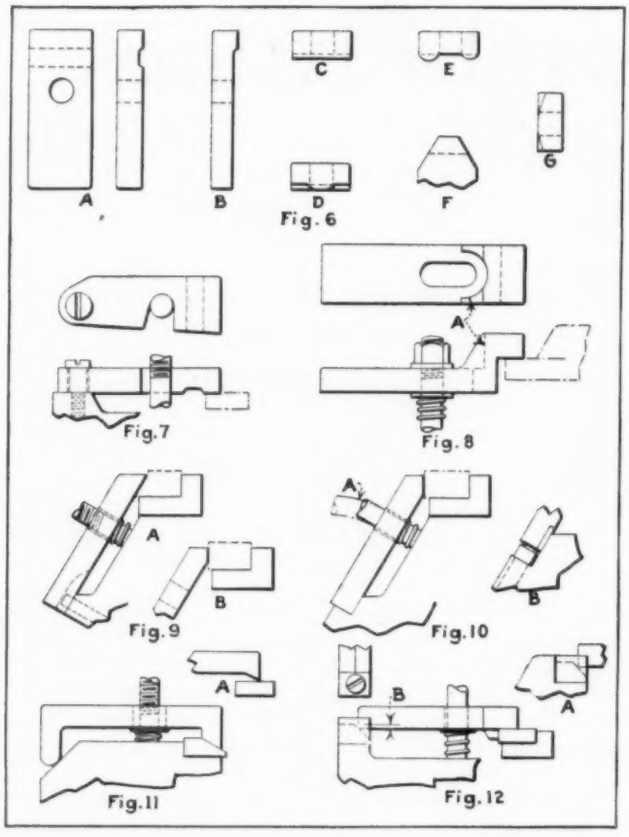


Fig. 6 — Various shaped ends for a standard form of clamp. Fig. 7—Simple type of swinging clamp. Fig. 8—Goose-neck clamp for keeping binding screw clear of the cutters. Figs. 10-11—Clamps that both locate and bind the work

on milling and profile fixtures that need a clearance for the cutter arbor, or to clear the rail of the machine. This clamp can also be made to swing as a three-point clamp similar to the others described.

The manner in which a clamp bites the work has considerable influence on the setting. The clamp shown at *A* will hold the work shown, but if cut as shown at *B* it would not bring the pressure to bear correctly. The correct manner in which this piece of work should be held is shown in Fig. 10. The clamp in this case is backed up at the tail end, which will save the binding screw from being bent as at *A*. This same clamp can be backed up in the method shown at *B*. The clamp shown in Fig. 11 has an L-shaped tail that slides down an incline. This clamp will work well on angle parts, as shown in the illustration, or on parts that can be speared on an unfinished surface, as shown at *A*. It has the disadvantage, however, that if the parts vary, the clamp is likely to cant from its normal position and bend the binding screw.

A clamp that will push over and hold down the work is shown in Fig. 12. This has a lug on the under side, which engages the work and pushes it against the steel stop when the clamp is tightened. The distance *B*, from the bottom of the clamp to the top of the incline, should not be more than $\frac{1}{16}$ in. when the clamp is in the binding position. This allows the clamp to slip back for loading purposes with only one turn of the screw. If necessary, the block can be backed up by the casting, as shown at *A*. The floating, or three-point bearing clamp, is shown in Fig. 13. This type can be used to hold two parts in a fixture, but is more generally used on rough surfaces. The tail end rests on one point only, to allow the clamp to compensate for irregularity in the work. The binding clamp may have a rounded end as shown, or the cupped washer shown at *A* may be used. The tail end may be rounded, or it can rest on bunters as illustrated at *B* and *C*. A simple arrangement that will make a removable clamp is illustrated in Fig. 14. When the latch is thrown aside, the hole in the clamp is large enough to permit slipping the clamp over the top of the screw.

Another removable clamp is shown in Fig. 15. When the clamp is drawn back, the large opening will permit it to be lifted off. The old U-type clamp, shown at *A*, is another form of removable clamp that can be used for rough work. A combination of these various features is shown in the floating removable clamp illustrated at Fig. 16. Another type of three-point removable clamp is shown in Fig. 17. This has the familiar keyhole feature with a cupped recess for floating. The binding nut in this case must be given almost two turns before the clamp can be slipped back under the head. This type of clamp is useful on lathe fixtures.

Hinged clamps are useful in tool construction, as they are positive in their action and in their bearings. Although the hinged clamp costs more to build, its use is recommended on small fixtures where the clamp has to clear the cutter by a small margin. The hinged clamp shown at Fig. 18 acts in a manner similar to those shown at Figs. 9 and 10. At Fig. 19, the hinged clamp is shown in a vertical position holding a part with a rounded shank. As the clamp springs in, it positions the part and binds it at the same time. The type of hinged clamp illustrated in Fig. 20 will support as well as bind

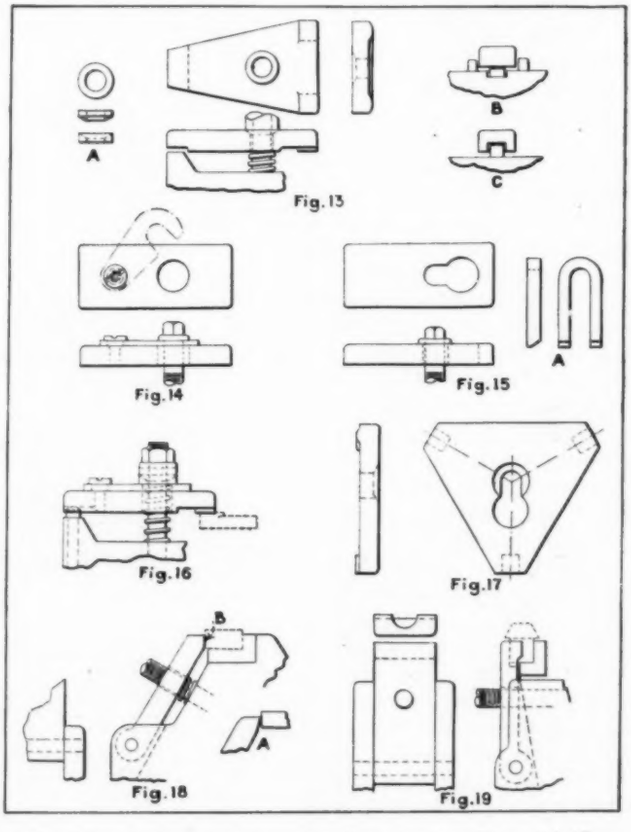
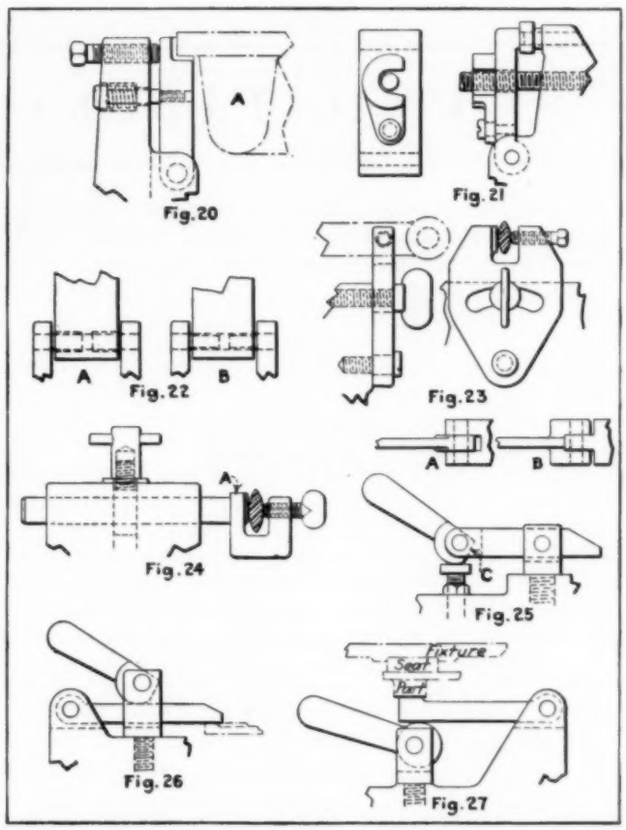


Fig. 13—A three-point suspension clamp. Figs. 14-17—Clamps that can be removed quickly. Figs. 18-19—Pivoted clamps for locating and binding



Figs. 20-21—Types of pivoted clamps. Fig. 22—Methods of obtaining a point suspension on pivoted clamps. Figs. 23-24—Clamping arrangements for holding thin arms. Figs. 25-27—Types of cam-operated clamps

the work. This is used on fixtures when milling the first cut. At Fig. 21 is shown the hinged clamp with a latch that can be thrown back from under the head of the binding nut to allow the clamp to swing out, so that the part can be removed readily from the supporting pins. All hinged clamps can be made into three-point clamps by relieving the toe to make two points and then counterboring out the hinged end, as shown at *A*, Fig. 22. Another method is to turn down the pin as shown at *B*. Taper reaming the clamp from each side will also produce this same result. The clamps shown in Figs. 25, 26, 27 and 29 are also of the hinged type.

Thin arms on castings and forgings will be found to have considerable variation because of the deformation due to changes taking place in the metal when cooling. These thin arms sometimes must be clamped in order to steady the part in the jig or fixture after it has been positioned and clamped. The clamp for holding these arms must be one that will vary in position. In Fig. 22 is shown a section of a forging held by a setscrew to a rounded point in a flat block. This block is free to swing on the shoulder screw, which in turn is kept from swinging by tightening the wing screw that passes through the curved slot. Another method is shown at Fig. 24, in which the piece *A* grips the thin arm by the wing screw, and is then held in place by tightening the lock screw.

Several methods of clamping by cam-operated clamps are shown in the illustrations at Figs. 25, 26 and 27. The cam shown in Fig. 25 can be either single or double, as shown at *A* and *B*. The cam is slabbed off at *C*, so that with a small movement the rail of the clamp will

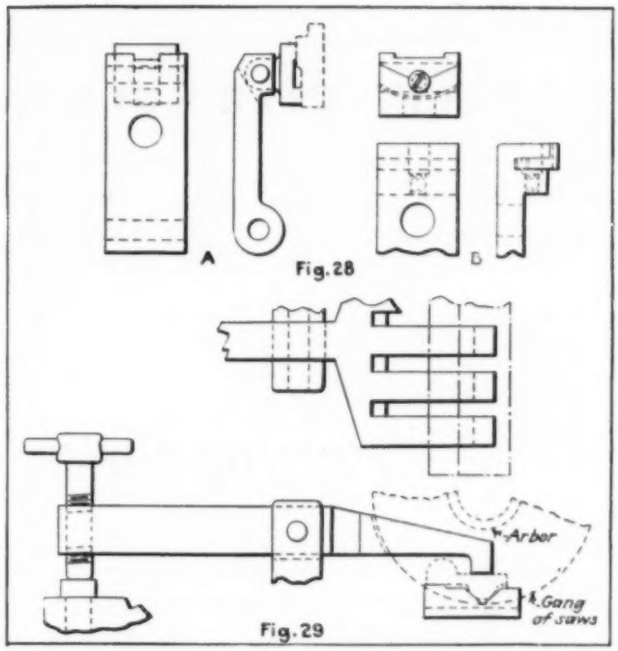


Fig. 28—Clamps with equalizer arrangements. Clamp for holding long formed strips

drop and give room to load the work in the fixture. The clamp illustrated in Fig. 26 acts on the center of the clamp in the same manner as a binding screw.

Many variations can be made with cams to pull down clamps working from the under side of the fixture. An equalizer can be used on the toe of the clamp to hold two parts, or to hold a part with stepped surfaces. The clamp illustrated at *A*, Fig. 28, has an equalizer which sets parallel with the body of the clamp, while the one shown at *B* has a cross-equalizer. The cross-equalizer clamp will be found useful in milling fixtures that handle right- and left-hand parts upon which the same operation is performed.

Small parts are often form milled or form planed in strips, and then cut into a number of small pieces. Usually, these are held in vise jaws for the cutting apart, but sometimes they are of such a shape that they can be held satisfactorily only by clamping in a fixture. A clamp for holding a strip of this kind is shown in Fig. 29. The right principle for all clamping is to use the most simple clamp that will hold the work effectively and apply the force in a direct manner. All of the clamps that have been illustrated can be worked up into various combinations to meet almost any kind of condition desired by the tool designer.

About Lithographing Sheet Metal

A sheet-metal product may possess all needed quality yet be difficult to market because of unattractive "finish." Among the finishes tending to overcome sales resistance is lithographing.

What is the lithographing process? How is the finish applied? What equipment is involved? For answers to these questions, see "Sheet-Metal Lithographing by Production Methods," next week.

· THE · FOREMAN'S · ROUND · TABLE ·

The following narrative is a "case" presentation of the topic. It has been written to involve some of the questions that arise in the average shop. For guidance in preparing discussion the questions at the foot of the page have been prepared

Putting Color on the Machinery

"I SAW a real new stunt, Ed, down in a big shop in Galanta last week. You know Williams sent me there to see what the trouble was with that installation our people made at the Perry plant, so I took the opportunity to run in and do some visiting at another shop I had heard about."

"What was the new wrinkle, Al?"

"Well, they have a pretty good assortment of machines there, and the first thing that struck my eye was the color scheme. None of that gloomy black that we've been brought up to, or that drab gray that's on your big lathe that looks as if the maker wanted to try something but didn't dare. This was real color. The bases of the machines were green, the bodies gray, all the guards were red, and the motors black. How does it strike you, Ed?"

"I like jazz, Al, but not in the shop. Looks to me as if someone went coo-coo down there. How could you expect discipline or serious work in a shop where they did frivolous parlor stunts like that?"

"That's what I would have said until I saw it, Ed. But, believe me, it was not bad."

"But I don't get your point, Al. Isn't standardization and conservatism the best procedure in the shop? Bright red is all right on the boy's toys, but we are not out to take the men's minds off their work by jazzing things up with color."

"This is a new idea to me, too, Ed, and I am not ready to advocate it in our shop, but it seems to me that there is something to think about in it, though. Ten years ago nearly all automobiles were black, now look at them—everything from canary yellow up and down the scale. It's the same with everything else. Even the ladies like to have the pots and kettles in the kitchen enameled in bright colors. Maybe this is an age of color, and everybody is tired of looking at the same old black or dark paints. Then, the lighter colors are cleaner, too, and they add more to the light and cheerfulness of the shop."

"I'd have to see it first, Al, and know that the men in that shop were satisfied, before trying it on our crowd."

"Glad to have your opinion, Ed, but I'm going to spring it at a foremen's meeting some day when they're all feeling pepped up."

Are the generally accepted standard colors for machine tools the best for all conditions, or has each shop its own problem to meet? Do bright colors add anything to the working conditions? Did the Galanta shop go too far?

All foremen are urged to discuss these questions vital to their work; of course the

discussion is not limited to foremen. Letters accepted and published will be paid for

Discussion of Earlier Topics

Paternalism or Privacy?

IT IS not a wise plan for the management of any firm to delve into the private home life of its men outside the factory. Most men resent having their personal affairs become the common knowledge of their employers, and rightly so. As regards shop conditions, we of the present generation do not consider clean shops, lockers, gardens and lawns as paternalism, but rather as everyday necessities to produce and maintain a healthy and progressive group of workers.

—C. L. HENRY, *England.*

Helping Tony Celebrate

HELPING the workmen celebrate their natal holiday is an ideal way of holding and building employee good will. Utilization of such an opportunity should be made with the idea of intrenching in the workman's mind the fact that the foreman is interested in the employee. Of course, the dignity of the foreman may be somewhat disturbed in the process of helping to celebrate, but it is worth some sacrifice to have the workmen see that the foreman is as human as the rest of them. Such an act will inspire confidence, better understanding, and increased co-operation. Little acts of this nature will bring a smoother relationship between labor and management.

—HARRY KAUFMAN.

Training the Foremen in Management

MOST foremen are not familiar with fundamental management principles. It is now acknowledged that the best way to impart this information is through the medium of regular classes conducted during working hours. Such classes should be handled by an instructor who not only can bring out forcefully the necessary points, but can lead a discussion of specific instances where certain policies are either detrimental to or conducive to the proper departmental functioning and interrelationships thereof. No attempt should be made to make these classes a clearing house for orders, but they should be a means of causing an awakening of foremen to a conscious application of the principles discussed.

—O. W. SCHRICKER.

THERE is nothing suggestive of bunkum in giving a foreman a chance to ground himself in the fundamentals of management. Such a course will enable him to get along smoothly with the men in his own department, and also with others on contacts which he makes with customers. The intangible assets of a business, which may be built up in part by foreman training, such as a clean record, fair treatment of the men, and still more, the good will of the customers, cost nothing beyond the daily practice of the principles emphasized by such a course.

If the foreman has any doubt that to most of his men he stands for the concern, let him try to remember how much the school board signified to him in his boyhood. He contacted with its members so rarely they didn't count, but the teacher—well, that was quite another matter!

—E. R. PLAISTED.

THE surest way to make a class in foremanship successful is for the management to get the foremen together and tell them that they need such a course, and that their future advancement will be more likely if they take it and profit by it. Then the manager should see each one personally and make it clear to him that he has shortcomings which it will be possible for him to overcome. Such special contacts will arouse much better cooperation than notices posted on a bulletin board.

—ENTROPY.

He Never Asks for a Raise

CERTAINLY Bill Hankins had a right to quit when he was not being paid what he was worth. On the other hand, Ed should never have given him such an opportunity, but should have noted Bill's dissatisfaction and nipped it in the bud. It was his duty as a foreman to give a timely raise when it was deserved, so that shop morale could be maintained and the working force kept functioning properly. After all, a slight raise would cost less that the cost of labor turnover involved.

—CARL JOHNSON.

THE foreman, if he is interested in his job, can and should, at all times, have a fair idea of the mental attitude of the men under him and if he must sound them out, let him do it cautiously. Ed must have thought, if he thought at all, that Bill worked hard to have the honor

THE · NEXT · TOPIC

ADVANCE QUESTION

Williams is disturbed when Ed spends too much for repairing a machine. But Ed thinks he would have had a bad time trying to get a new one. What repair policy should be adopted?

of being at the head of the class. If he had kept his eyes open he would have seen that Bill Hankins had ambition to make more money through his better grade work. If Ed had watched this man, he could have seen by his general behavior that he was becoming dissatisfied with his job. —O. VOGETZER.

IT IS my belief that Bill Hankins should have asked for a raise before quitting although he was correct in feeling that the boss knew enough about him and his work to be able to raise him without asking for it. If a man is worth more money, it is poor policy for the boss to wait until dissatisfaction with his present wage has set in before offering him a raise. A raise, if given voluntarily to a man who deserves it, is appreciated far more than one that has been asked for.

—C. H. LATTNER.

THE foreman should constantly endeavor to encourage his men. When a man deserves a raise, it should be given to him immediately so that discontent may be avoided, and his production kept at a high level. Losing a well-trained worker who may go to a competitor costs more than the increase necessary to keep him. It would be a good thing to establish a definite system such as considering each man's case every six months after his employment. I feel sure that such a system would provide the incentive to every man to obtain his raise at every six months' period. —R. E. PETERSON.

IF BILL HANKINS believed that his job was satisfactory in every respect except for wages, he should have asked for a raise. He should not have depended upon his employer, but should have been self-reliant. On the other hand, it is good policy for a firm to increase the pay of employees where it is deserved in order to maintain a satisfied group of workmen.

—JOHN MARK MAY.

Extra Pay for Extra Effort

I DO not believe that there is any need for giving a bonus over the piece rate when a man produces 70 pieces per hour. It is quite possible that the man making this high production is above the average in ability. Consequently, in fairness to the average worker, the rate should not be cut until it is definitely proven that 70 pieces is a fair task under the new method. Then the man making the suggestion should be rewarded with a bonus for his interest. In any case, piecework rates should be adjusted at intervals so that a fair standard may be maintained. —R. Q. TARBUTTON.

THE OPERATOR who increases his production should be rewarded with a bonus above his piece rate. In the first place, he is entitled to a reward for the expenditure of personal energy, and in the second place he is entitled to some compensation or reward which in some measure will be in proportion to the increased benefits to the company on the basis of greater production. If such a reward is withheld, the operator is bound to feel that he has been unjustly treated, and will fail in future to take advantage of any improvements that he may think of. The effect on his fellow workmen will be to lose their co-operation also. —R. B. SMITH.

WHEN a man finds a new method of doing a piece of work, a bonus should be given and the piece rate changed. If the piece-work rate is not changed, the earnings in a short time will be far out of line with those usually made at such work, and dissatisfaction will be created within the department.

Suggestion should be taken care of by a committee especially designated for that purpose. It would be well to have shop representation on such a group. I believe that a flat sum should be paid for all worth-while ideas.

—J. W. WELDON.

ANY man in the shop regardless of his job should be given a bonus if he discovers a method that will cut production costs. It is impossible to give any set rules as to what this bonus should be, since conditions vary widely for different types of work. Usually, a larger bonus should be given for an improvement of a standard job that is to run indefinitely, than for one which is likely to become obsolete in a short time. Immediately after the new method is discovered, however, a new rate should be set. —J. H. FEDLER.

Shall It Be Lay-Offs or Short Time?

UNDESIRABLE persons should be weeded out during slack periods and then short time instituted. It is preferable to work the regular number of hours daily, with fewer days per week, than to shorten the daily hours. Under such a system the workmen can better utilize their free time for other work or for recreation. Such an arrangement, honestly and frankly explained, together with the assurance to re-employ all former men on full time as soon as conditions permit, will work the least hardship to the greatest number.

—GUSTAV KOPSCH.

PART time seems to be the fairer method of all, but it is very doubtful if the older men would vote for it. However, I do not believe it should be necessary for the men to vote on this question, as it appears to be a problem for the management. While I favor the vote, because it makes the men entirely responsible for the decision and renders the job a little less distasteful for the foreman, still I feel much the same as Ed does, that a ballot would show a vote for the layoff, unless there happened to be an unusual percentage of new men.

—WALTER W. YAEGER.

Too Many Safety Signs

IF A large sign were placed outside of a shop window by an advertising concern you would certainly notice it. But if this sign remains there for a long period, the result is that you no longer notice it. It has become part of the surroundings, and if there were many signs the result would be the same. But if every week the sign were changed, you would undoubtedly notice each of the changes. Does not the same hold true for safety signs? —A. MATHIEU.

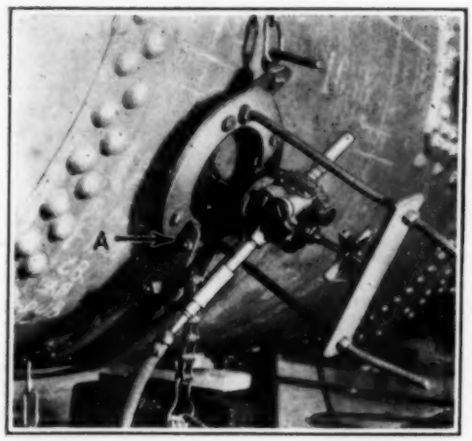


Fig. 1—Drilling device for outside of boiler shells

Portable Drilling Devices

By Fred H. Colvin
Editor, American Machinist

LOCOMOTIVE repair shops must drill holes at all sorts of angles and frequently in awkward positions, and portable drills, usually air driven, are largely used. Devices for holding these drills to their work vary widely, each shop having a variety of methods.

For drilling holes in boiler shells, the support shown in Fig. 1 has been found effective and convenient. It consists primarily of the base ring cut from steel plate, with four short bolts that act as feet to position it squarely with the boiler shell, and means for fastening the chain that goes around the boiler shell and holds the device in place. The ear at *A* carries a sprocket with a ratchet and pawl, so that the roller chain shown can be used to draw the other chain tight around the boiler.

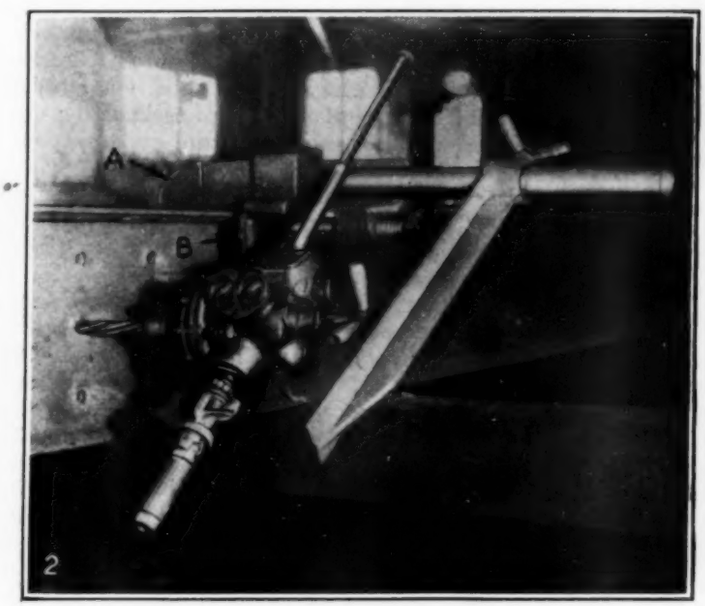
After the frame has been drawn against the boiler, the air drill is put in place so that the crossbar on the two long bolts, or stays, acts as an "old man" and permits the drill to be fed into the work by the usual method.

Other types of apparatus is shown in Figs. 2 and 3. They combine the old style of "old man" with a clamp that is easily attached to a bar or beam and can be quickly set up for any job. In the one shown in Fig. 2, the main bar has a foot, *A*, that goes over the beam, also a movable clamping jaw, *B*, operated by a screw working through a nut on the side of the main bar. The arm against which the feed screw abuts is easily adjusted by means of the handled screw on the end.

A similar application of this device is seen in Fig. 3 where it is in use on a locomotive frame. This illustration shows how it can be used in close quarters.

A permanent drilling frame is used for countersinking rivet holes on the inside of the flanged sheet, as in Fig. 4. The frame is forged to the right dimensions to hold a short air-drill, the drill end being held in a sort of yoke by a suitable capscrew. The feed screw goes through the outer end of the frame. This arrangement makes a drilling rig that is light and easily handled, and one that can be used in places where the room is limited.

The type of "old man" shown in Fig. 5 has a number of modifications. However, it is very simple and is easily adjusted on any smokebox. With the bar across the center of the smokebox ring, a central rod that goes



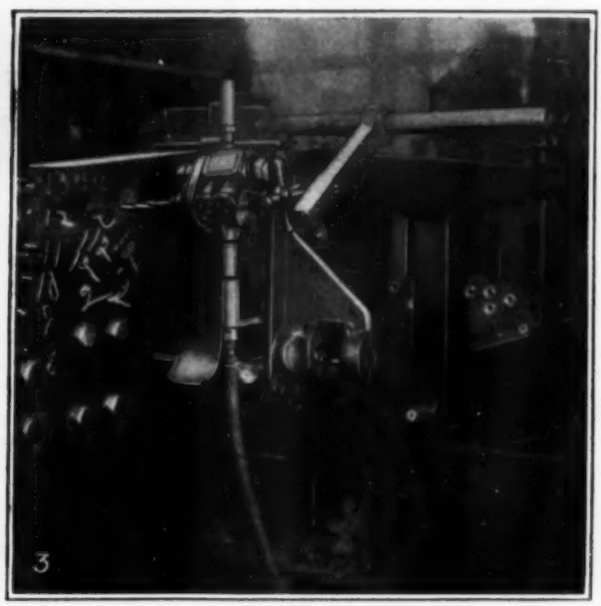


Fig. 2—Combined clamp and "old man." The clamp holds the "old man" in position and allows it to be easily and quickly applied. As shown, it is being used on a large I-beam but it has many other applications. Fig. 3—Another use for a similar combination clamp and "old man." This device is being used on a locomotive frame and can be applied in close quarters more readily than the older type of "old man" Both types are easily made and used

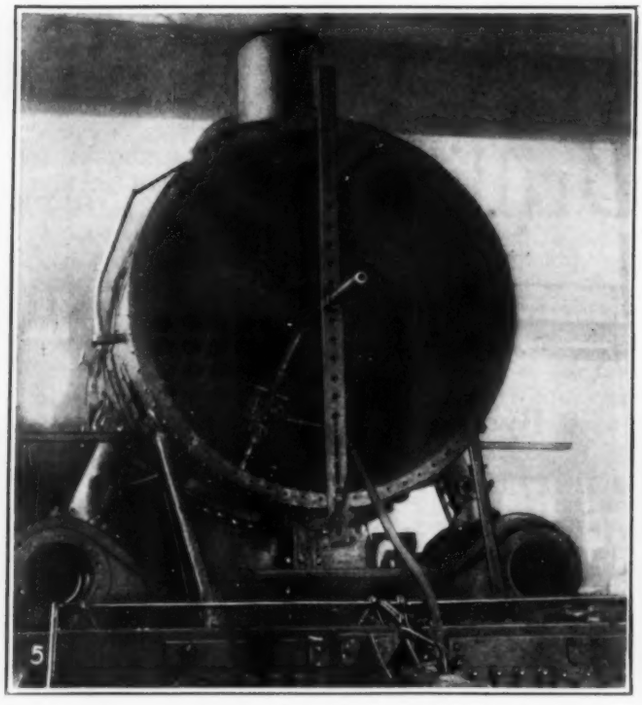


Fig. 5 — Universal drilling-brace for front ends of boilers. The thrust bar, which is a heavy tube, runs through one of the holes in the crossbar to a flue hole. This method of support gives the air-drill a wide range without moving the front bar. It is better, however, not to have the drill at too great an angle with the crossbar.

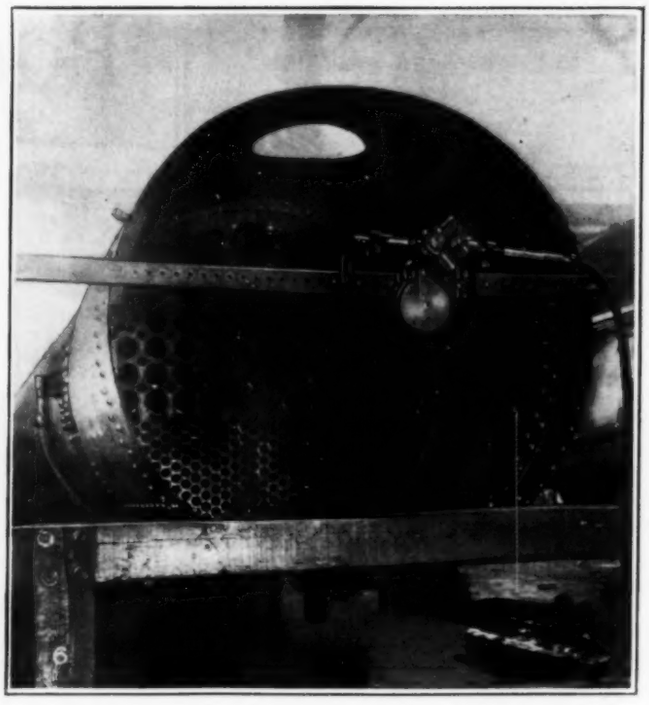


Fig. 6—Cutting out, or rolling, flues. The drill is supported on the crossbar in front of the boiler. It can readily be moved and can cover a large area by means of an intermediate shaft provided with universal joints

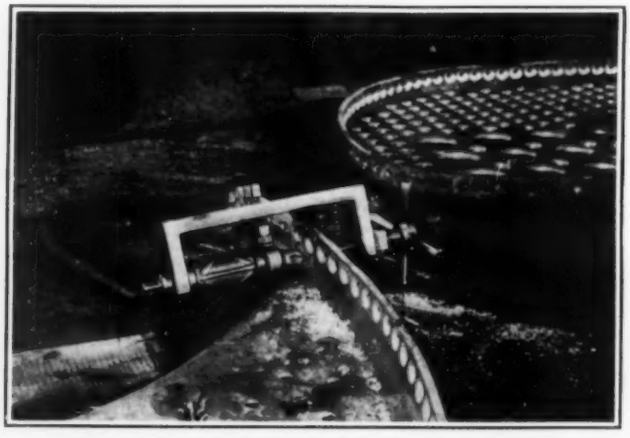


Fig. 4—Countersinking rivet holes on flue-sheet flanges. The air drill is made part of the fixture so that the whole rig can easily be handled by one man and readily moved from place to place. The screw feed can be seen at the outer end

through one of the holes of the bar and into one of the flues (or flue holes, if the flues have been removed), takes the thrust of the drill. With the thrust rod in or near the center, the drill can be used through quite a wide area without shifting the holding device. The drill could, of course, be shifted to any position, but it is best to have the bar across the front somewhere near the line of thrust. Otherwise the bar is more easily deflected.

A modification of this kind, although used in an entirely different manner, is seen in Fig. 6. Here the crossbar supports the air drill and holds it in any desired position across the boiler front. This device is used in cutting out flues or in expanding flue ends. In practice, the drill covers a rather large number of flues from a single position. The driving bar is provided with universal joints. The cross bar has holes spaced to accommodate the frame that supports the air drill to make it easy to shift to any desired position.

Lancia Methods—*Discussion*

By Paul Lindner

I HAVE been following up the articles in the *American Machinist* by J. A. Lucas, pertaining to the Lancia methods. While the articles are very good, I beg leave to criticize some of the tooling, and particularly the methods used in machining the connecting rods, as published on pages 381 to 385, inclusive.

The operation illustrated in Fig. 2 is all right as far as the milling itself is concerned, but by the method of milling one piece only at a time too much time is wasted to permit getting volume production.

The method of holding the work as shown in Fig. 3 is very good but the production is necessarily low. As far as the cutting tools in Fig. 4 are concerned, the operation is first-class but the methods of holding are too slow. In fact all of the operations can be improved upon. It is very apparent from the illustrations that maximum production is impossible.

I absolutely agree with Mr. Lancia as to the necessity of line reaming in a great many cases, but, while the fixtures for this purpose are very neat, the methods of operation are too costly.

I do not think much of the gages for cylinder testing, illustrated in Fig. 14, page 248, nor of the fixture for hand reaming the control bearing shown in Fig. 17 on the same page. My criticisms are intended to be constructive only, as I am interested in eliminating waste.

Our Gravest Business Problem

By Dr. Julius Klein

Director U. S. Bureau of Foreign and Domestic Commerce

THE wastefulness of our distribution system is beyond question the outstanding issue now before the industrial and commercial world. This is true regardless of the angle from which the matter is viewed; the values at stake, the persons involved, the extent of the areas concerned, or the actual and potential losses. The fact is that we know considerably less about the distributing of goods than the making of them.

If we estimate the losses in distribution through inefficiency to be only ten per cent of the total value of our domestic trade valued at eighty billion dollars, a conservative figure suggested by the calculations of engineers appointed in 1927 by Mr. Hoover to outline his campaign of waste elimination, the result would reveal a loss of eight billion dollars through this medium—one and one-half times the nation's export trade. To take but a single item, the careless administration of retail credits through over-extensions, slipshod installment selling, etc., piles up an annual loss estimated at not less than one billion dollars a year. With our entire distributive system in a state of flux it is important that every possible effort be made to gage transformations and estimate their effects upon the whole business system. In these days of uncertainty as to the outlook for certain industries or trade areas it is important that every effort be made to eliminate every item of unnecessary expenditure. The fundamental philosophy of lowering prices so as to increase consumption, of minimum margins of profits and mass turnover, which have been so conspicuous an item in the success of many of our industrial undertakings, can be applied with equal effect to distribution.

> "The major problem is the application of the flow of data from investigators to the actual problems of marketing. Therein lies the great field for the future improvement of commercial conditions in this country. This is the gravest problem now confronting our business world."

Today every prosperous manufacturer knows accurately each item of his costs. But can we safely make the same statement of our distributors? It is certainly the exception rather than the rule for any establishment to have its sales costs accurately distributed by percentages as among its various commodities or items such as warehousing, delivery, advertising, clerical high, traveling salesmen, market analysts and so on.

There can be no doubt whatever as to the need for improvements in our distributive machinery if it is to maintain profits anywhere near comparable to those of other phases of our business life. Recent tabulations by a responsible research agency of the income tax returns of seventeen groups of corporations in industry and trade for 1925 have revealed some interesting facts. The data show a profit of 5.8 per cent for manufacturing, 5.7 per cent for amusements, 12.5 per cent for banking, 5.7 for mining, 4.6 for construction, etc. But retailing and wholesaling had a profit of only 2.2 per cent.

Another survey as to the causes of the difficulties encountered by some concerns in 1925 revealed as the chief obstacle which impaired the prosperity of 91 per cent of the firms involved, the "greatly intensified competition" which they were encountering.

But in answer to a query directed to these distressed firms, "What are you doing about it?" 73 per cent of them reported that they were endeavoring to reduce production costs, and only 29 per cent indicated any efforts to cut sales expenses. In spite of repeated pronouncements in the trade press, and by scores of research agencies and competent observers generally during recent years as to the imperative necessity of more effective, profit-yielding distribution, these facts still appear to require repetition and emphasis. But just what should we know about distribution and how can we discover those facts? Wherein are its major wastes and exactly what is being done to remedy them? The problems which are uppermost in the minds of our distributors, according to the thousands of queries coming to the Department of Commerce each day, seem to be primarily of two varieties; (1) Where can things be sold? and (2) How much should it cost to sell them? In other words, the first confession of our shortcomings in this regard is in the field of wastefulness of "blind" marketing, of attempting to sell in territories whose sales possibilities have not been carefully investigated.

Then there is the wastefulness of attempting to exploit remote territories whose prospects seem promising but whose inaccessability makes for costly traveling salesmen's campaigns. Such far-flung operations are all too frequently for the sole purpose of gratifying the vanity of the executives of the firm whose product has been described to them by some energetic advertising solicitor as "an undoubted national necessity and, therefore, deserving of a national market." For some commodities such country-wide distribution is not only feasible but distinctly profitable. For these the splendid research services set up by some of the larger national periodicals have rendered valuable assistance in the development of intelligent far-flung sales operations. But there are also thousands of others which instead of seeking the pot of gold at the further end of a nation-wide rainbow would be far more profitably engaged by concentrating their digging for the precious metal right within their immediate neighborhood. The perils of "going national" are subtle but costly for those who are not in a position to live up to the responsibilities involved in the relative cost of such widespread sales efforts.

There is another phase of the distribution situation

which is worthy of special attention, namely the element of the constant possibility of change in market demand through style influences or through shifts in buying power or particularly through the introduction of new competing commodities. Silk goods are threatened with rayon, leather heels with rubber, wooden construction materials with metal, the styles of shoes are radically affected by increased motor traffic, the electrical industry contends with combustion engines and in turn launches competition with natural ice refrigeration; and so on down the line of almost every major industry. It is of supreme importance, therefore, that the manufacturer should be intimately in contact with the ultimate consumer of his commodities.

This does not necessarily involve the elimination of the jobber, commission house, wholesaler, or other distributive intermediaries, many of whom perform valuable services in some lines, though they are gradually disappearing in others. I refer particularly to the urgent need of watchful observance by the producer of the conditions and desires of his ultimate consumer in order that any change in demand may be anticipated and production allowance or alternation made for them. The distress of certain plants in the older industrial centers of the country is all too frequently due to precisely such lack of contact with their ultimate consumers. In these days of kaleidoscopic changes in styles, in methods of communication, and in the general increasingly sensitive response of consumer to new impulses, any such "blindness" on the part of the manufacturer is certain to spell ultimate disaster.

The maintenance of such contacts by no means requires an elaborate costly research agency. The facilities of the Department of Commerce and numerous other organizations are ample to keep any intelligent, farsighted manufacturer advised as to market changes and the factors which affect the demand for his product.

Large Number of Agencies at Work

It was not until the postwar depression of 1921 that systematic and intensive campaigns for better distribution were launched. In January of that year Mr. Hoover appointed an Engineers Committee on the Elimination of Waste in Industry whose findings touched on many phases of the problem. Simultaneously, during 1921 and 1922 volumes appeared by such authorities as Nystrom, Cherington, White, Ivey, Macklin, and Fred E. Clark.

Today the number of agencies conducting research bearing directly or indirectly upon marketing has increased to such an extent as to necessitate a catalog of them and of their functions. With a view to eliminating duplication among them and of introducing some efficiency in this respect among these so-called efficiency organizations, the Department of Commerce is now issuing an annual list which in 1927 comprised 544 agencies. Among them are varieties of commercial or business organizations, publishers of periodicals and trade journals, trade associations, chambers of commerce, advertising agencies, research bureaus of large factories, academic institutions, foundations, universities, experiment stations and some fifty governmental agencies and bureaus. Incidentally, the Department of Commerce has undertaken to assist in the co-ordination of their work through the agency of an Advisory Committee representing various groups of such distribution research organizations. Through this advisory body an attempt is being made to eliminate major duplications and to insure a fairly complete coverage of the field through collaborative arrangements.

Among the more substantial contributions have been numerous investigations in the engineering and technical fields by such groups as the McGraw-Hill Publishing Company, the Chilton Class Journal Company, the Penton Publishing Company, and others. These agencies have conducted numerous surveys of the distribution of such products as lamps, wire rope, industrial motors, roofing, electric heating equipment, paint, etc. The Crowell and Curtis publishing companies have made valuable contributions in the shape of analyses for their clients of the buying power of cities and counties including data on retail outlets, banking, automobile ownership, electric lighting, and other useful indices. The leading mercantile and business service agencies have likewise been active in recent years on distribution problems, notably Bradstreet's, Dun's, the Bookmire Economic Service, and the Standard Statistics Company.

Regional Market Surveys Planned

The Department of Commerce has been concentrating its efforts on four or five major distribution problems, the first of which is the development of a series of regional market surveys which are intended to supply a compilation of basic data on the general commercial structure of the entire country. For the purposes of these surveys the country has been divided into nine regions based on differences in economic and business factors. The first of the series, that on the Southeastern states has recently been completed. Similar surveys on New England, the Pacific and Southwest, and the Midwest are now in progress. These surveys undertake to analyze what might be called the "consumer differences" in the various sections—the sources of income, influences affecting buying power, facilities for distribution including wholesale and retail marketing arrangements, merchandising and credit trends, factors involving advertising, store and plant location, merchandising methods, commodity preference and a host of other details.

Particular attention is being given in these regional surveys to the question of commodity movements into and out of the given areas through the collaboration of railway lines and truck services. Hitherto there has been almost no information available on this vital question of the flow of commodities from one part of the country to another.

Another approach to the same problem is along the line of specialized analyses of the marketing facilities and practices in particular commodities. An invariably perplexing question which confronts each firm about to reach out beyond the confines of its immediate locality is "How large a territory does it pay to cover?" A prime consideration, of course, is to restrict operations within the area of profitable operation, avoiding by all means the dangerous allurements of nation-wide distribution when the costs are likely to be excessive.

With all of these various efforts under way on the part of literally hundreds of agencies, official and unofficial, academic and commercial, it would seem as though the actual materials for the improvement of this situation would be available. The next and major problem, however, is the application of the flow of data produced by these investigating agencies to the actual problems of marketing. Therein lies the great field for the future improvement of commercial conditions in the country. This is the gravest problem now confronting our business world.

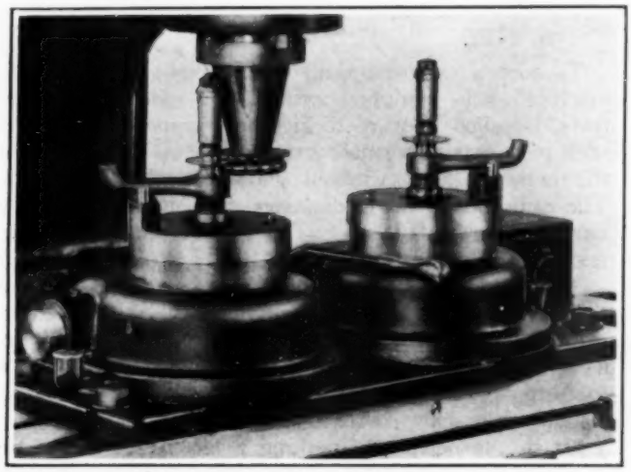
IDEAS · FROM · PRACTICAL · MEN

The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the metal-working industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from a minimum of five dollars upwards, depending upon their merit

Doing an Odd Job in a Milling Machine

By Frank Waldo

The illustration shows two rotary-type fixtures used in milling portions of faucet bodies. Both fixtures are mounted on the same base and are driven by worm gearing through a universal shaft connected to the feed mechanism of the machine. A selective clutch located between the fixtures permits either one to be set in motion at the will of the operator.



Rotary-type milling fixture

While the work in one fixture is being milled, the other fixture can be loaded or unloaded. After the work in one fixture has been completed, the table of the machine is traversed to bring the other fixture in position for its work to be milled. The completed piece is then removed, another piece put in place and the cycle of operations is continued.

The work is clamped upon a central stud and is positively driven by a pin near the outer edge of the rotating part. The material is brass and the production is 175 pieces per hour.

Handling Bar Stock to the Screw Machines

By Milton Wright

Bar stock of whatever size is awkward material to handle in a shop, especially if floor space is limited and the stock room is at some distance from the screw machines. Because of its length it cannot be handled easily on elevators, and the same condition renders it difficult to negotiate around sharp corners in shop aisles. The two-wheeled trailed truck shown separately in Figs. 1 and 2 attached to a storage-battery truck by which it is hauled around the shop, was designed and built in the factory of the Hartford Machine Screw Company.

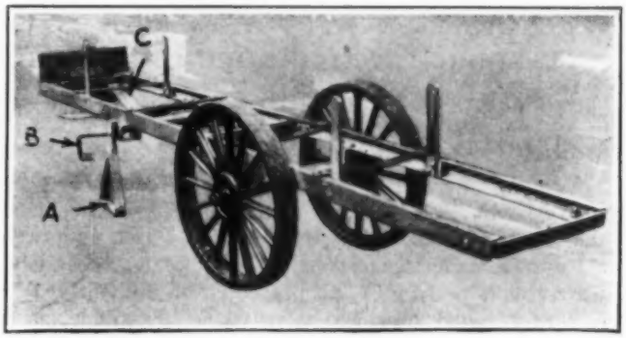


Fig. 1—The trailer truck unloaded

The frame of the trailer is made of light channel iron. It is nearly but not quite balanced on its single axle and is therefore easy to push around the shop by hand, even when loaded. A slight predominance of weight toward one end is borne by triangular-shaped supports, one of which may be seen at *A* in Fig. 1, that are so hinged to the frame that they may be swung up out of the way, as in Fig. 2, when the electric truck takes over the job of transportation.

A yoke, one end of which may be seen at *B* in both illustrations, is swivelled by a king-bolt to the frame of the trailer and engages the platform of the electric truck when the latter is run under it. Integral with the swiveling yoke is a forward extension *C*, Fig. 1, which may be likened to a tongue, or drawbar, having in its outer end a hole for a coupling pin by which it attaches to the electric truck. The only alteration or addition to the

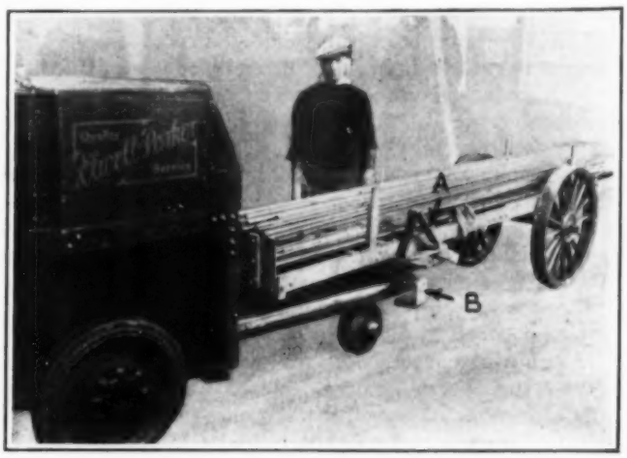


Fig. 2—Loaded trailer attached to electric truck

electric truck is a block, or bolster, permanently fastened to the platform close to the battery box, where it in no way interferes with loads to be transported.

The trailer is taken to the stock room, which is across the yard and at a different level from the screw-machine department, by hand or by means of the electric truck, as may be most convenient, and is loaded with bars in accordance with an advance shop-order as the attendants find time to do the work. When ready to be transported to the shop, the electric truck is called from its other duties and attached to the trailer by the simple expedient of dropping the coupling pin through the hole in the drawbar into the hole in the bolster.

Elkonite Electrodes and Projection Welding

By George T. Kerr

We had to make a large quantity of hand-hole plates, each of which was to have eight washers spot welded to the outer edge, as shown in Fig. 1. Three spot welds were to be made on each washer. The plates and washers were simple press jobs and presented no difficulty.

The welding, however, gave us some trouble, as the copper electrodes soon got soft and would mushroom, requiring frequent redressing. If not redressed, the metal would not fuse properly and the work would not pass inspection. After looking around for a harder metal from which to make our electrodes, we found an alloy of copper and tungsten, called "Elkonite," which helped us out of our trouble. We also hit on another method of doing the work, which, for want of a better name, we called projection welding.

Fig. 1—Washers welded to hand-hole plate

As the holes in the plates and washers were $\frac{9}{16}$ in. in diameter, three projections were raised around the holes in the plates, as shown in Fig. 2, which is an enlarged section.

The upper electrode, Fig. 3, was made of copper, a $\frac{19}{32}$-in. clearance hole being drilled in the center. Surrounding the clearance hole, three holes were drilled, into which $\frac{3}{16}$-in. Elkonite rods were placed and held by silver solder.

In the lower electrode, Fig. 4, also made of copper, a $\frac{9}{16}$-in. hole was counterbored in the center and at the bottom of the counterbored hole, a hole was drilled and tapped for a 6-32 screw. A porcelain bushing of the same grade as the porcelain used in spark plugs was fitted to the counterbored hole and was held in place by a filister-head screw. The porcelain bushing acted as a pilot on which to place the plate and washers.

With these electrodes, we welded 4,000 washers on 500 plates in one minute per plate and had to redress the electrodes but once, making three spot welds in each washer at each stroke of the welder. We found it necessary to keep the face of the lower electrode clean and free from particles of porcelain, otherwise an arc would result. If the bushing broke, as it sometimes did, replacing it was but the work of a few minutes.

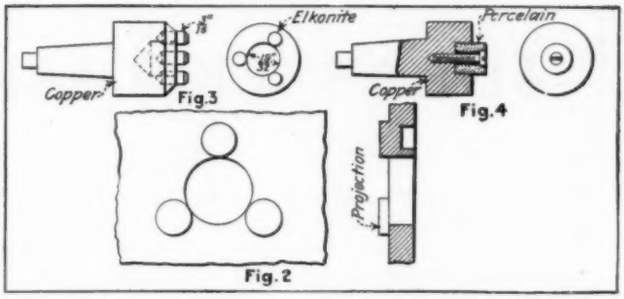


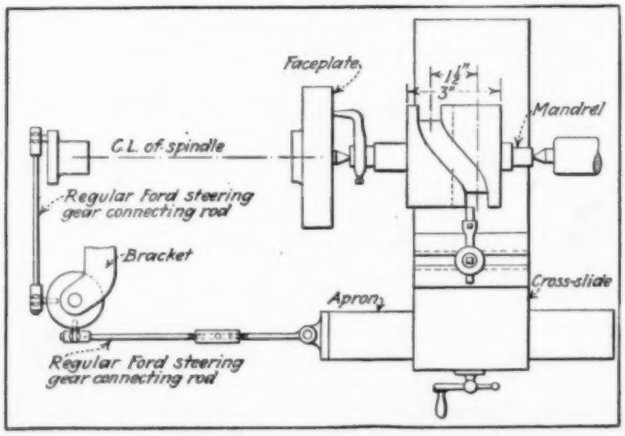
Fig. 2—Enlarged section of plate showing projections. Fig. 3—Upper electrode with Elkonite rods. Fig. 4—Lower electrode with porcelain bushing

An Improvised Cam-Cutting Attachment

By John R. McDade

To keep a wallpaper mill running day and night, the machine shop, equipped with a few old-style machine tools, is called upon to tackle some unusual jobs. One such job—cutting a small drum-type cam—brought forth the home-made attachment shown in the illustration. The cam was $3\frac{3}{8}$ in. in diameter, 3-in. long, and was to have a throw of $1\frac{1}{2}$ in. The groove was to be $\frac{3}{4}$-in. wide and $\frac{1}{2}$-in. deep.

The blank was mounted on a mandrel placed between the centers of an ordinary engine lathe. To the rear end of the lathe spindle was attached a plate carrying a ball from a discarded Ford steering gear, so placed as to form a crankpin. A plate attached to the bed of the lathe by a bracket carried two such balls placed 90 deg. apart in the periphery, making a bell crank. The ball in the plate at the rear of the spindle was connected to one of the balls in the bell crank by a steering-gear connecting-rod salvaged from an old Ford car. A like rod connected the other ball in the bell crank to the carriage-apron through an ordinary rod, both of which rods were connected by a turnbuckle. It will be seen that through this combination, rotary motion of the lathe spindle will cause reciprocating motion to the carriage, the amplitude of which is dependent upon the off-center distance of the ball acting as a crankpin. When



A home-made cam cutting attachment

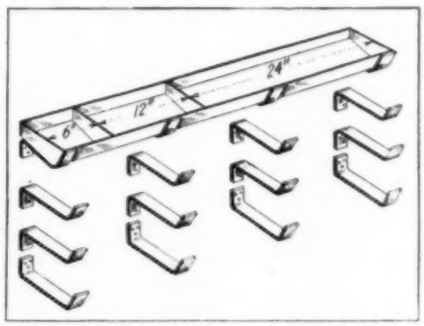
the device is in use, the longitudinal feed gearing is, of course, disconnected.

Two tools, one right- and the other left-hand were used in cutting the groove, and care had to be taken in grinding them to the proper clearance. The carriage was adjusted for the side cuts by the turnbuckle. Feeding for depth was by the regular cross-feed screw. Cams having greater or less throw can be cut by changing the position of the crankpin.

Combined Bins and Racks for a Small Shop

By Henry C. Francis

The main thing to be considered in storing material is to be able to find it when wanted. Storage should also be as convenient as possible and not take up more shop space than necessary. Finding small pieces cut off from large bars is even more difficult than locating full-sized bars. A form of rack for bars of any kind in a small shop is shown herewith. The regular or full-length bars are held on the lower hooks. The upper hooks carry a long pan or trough that can be divided to suit the needs of that particular shop. As shown, it has compartments, 6, 12 and 24 in. long to hold pieces of varying lengths. In this way, short pieces can be kept together and readily found when needed.



Combined bins and racks for steel

Protractor-Triangle as a Tangent Rule

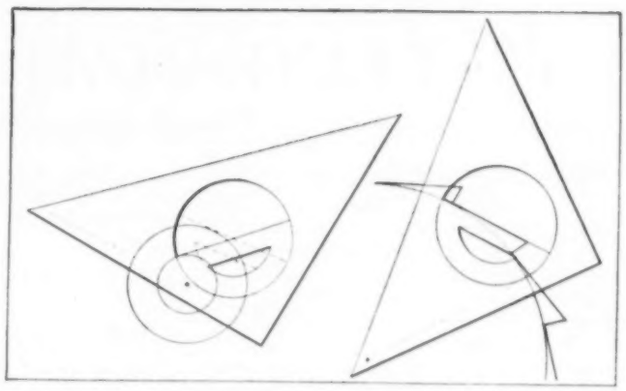
By Henry Simon

Jena, Germany

Drawing a line tangent to a circle can easily become something of a job when it has to be repeated many times. A case in point is the drawing of a ratchet wheel or milling cutter, and there are numerous similar cases.

At the expenditure of a very little work, the well-known protractor-triangle can be put into shape so that it will serve as a most efficient tangent-rule, provided the tangent lines required are comparatively short. All that is necessary is to drill a series of small holes along one edge of the triangle, just the right size for a pin, to be used as a center, and then to use the protractor in the manner indicated in the illustration. The two views show the triangle in place for drawing lines tangent to the smallest and largest circles to which the instrument is adapted. For the common size of this instrument, the smallest and largest circles will be about 2 and 11 in. in diameter, respectively.

In order to cover the full range of diameters between these limits, it is necessary to space the pin holes so that the range of one will overlap that of the other. A convenient way of doing this is to use the whole- and half-number marks (1, 1.5, 2, 2.5 and so on) from the A and B scales of an ordinary 10-in. slide rule for the spacing. This gives two or three more holes than necessary, but spaces them so that they are certain to overlap in their tangent-drawing functions.



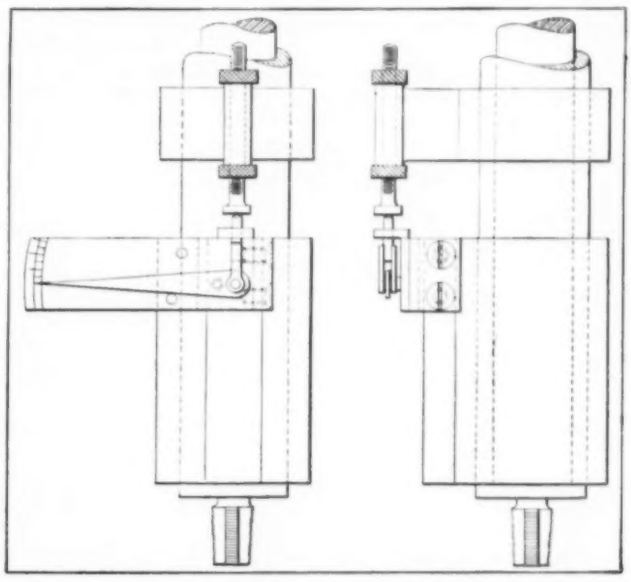
Protractor-triangle used for drawing tangential lines

A Tap-Depth Indicator

By P. H. White

The indicator shown in the illustration was designed for use in connection with a tapping operation in the drill press. The tap in question is for $\frac{3}{4}$-in. pipe, and a number of holes on close centers are to be tapped. It is quite essential that all holes be tapped to the same depth within a fraction of a turn.

The indicator is attached to the bracket that guides the lower end of the drill spindle. A collar clamped to the spindle sleeve carries an adjusting screw that may be raised, or lowered by means of knurled nuts at the top and bottom of an extension on the collar. As the collar moves downward with the travel of the spindle, the head of the adjusting screw comes in contact with the plunger of the indicator and transmits its motion to the pointer. The graduations are marked in turns, as figured from the leverage of the pointer and pitch of the thread. The adjusting screw is set for the proper depth.



Indicator for depth of tapped holes

· TECHNICAL · ABSTRACTS ·

Welding of High-Chromium Alloys

The weldability of corrosion-resisting alloy steels has become important because of their greatly increased use in many different types of equipment. There are many of these alloys on the market, and they fall into six groups as far as their welding technique is concerned. All of these alloys form quantities of infusible chromium oxide together with small amounts of other oxides which necessitate the employment of a special flux. In the welding data following it is important to remember that a neutral flame just large enough to insure proper fusion is required.

Group 1—Rustless Iron

Carbon less than 0.12 per cent; chromium 12 to 15 per cent.

Good butt welds can be obtained in such metals up to $\frac{1}{8}$ in. in thickness without beveling. It is essential that flux be applied along the line of the weld to both the top and bottom surfaces of the sheet and also to the welding rod. A neutral flame should be maintained since an excess of acetylene will increase the carbon content of the weld thus lowering its resistance to corrosion, and, on the other hand an excess of oxygen will cause porosity due to excessive formation of infusible oxide.

As a result of the high temperatures attained, rustless iron has a tendency to be brittle in the weld metal and the sheet adjacent thereto. Toughness may be restored by annealing at a temperature between 650 and 700 deg. C. and allowing to cool slowly. Annealed welds will stand severe bending.

Group 2—Stainless Steel

Carbon over 0.30 per cent; chromium 11 to 17 per cent.

These steels can be welded by the same procedure as for rustless irons, although there is little demand for such treatment. All welds should be heat-treated to 750 to 800 deg. C. followed by slow furnace cooling.

Group 3—Rustless or Stainless Iron

Chromium 17 to 25 per cent; nickel 7 to 9 per cent.

Rustless or stainless irons containing nickel are not subject to brittleness after being exposed to the heat of the blow-pipe. They do not air-harden and have appreciable ductility even without heat-treating. Welds in 18-gage sheets have a yield point of 50,000 to 60,000 lb. per sq.in., an ultimate strength of 65,000 to 70,000 lb. per sq.in., and 15 per cent elongation in 2 in. over the weld.

Group 4

Nickel 17 to 22 per cent; chromium 7 to 25 per cent.

Care should be exercised to control expansion and contraction of these alloys since they are liable to be red-short and crack in the weld just after solidification. No heat-treatment is required.

Group 5—Extra High Chromium Alloys

Chromium 25 to 30 per cent; carbon less than 0.30 per cent.

These alloys have great resistance to chemical corrosion and oxidation. When above $\frac{1}{4}$ in. in thickness, infusible oxides cause difficulty in welding. The heat of welding causes considerable grain growth with resulting brittleness; a condition which cannot be removed by heat-treating.

Group 6—Castings

For welding castings containing high carbon and designed for wear resistance, it is preferable to pre-heat to a good red heat to avoid cracking. Cooling should be relatively slow, and may be followed by the proper heat-treatment to obtain requisite hardness. An excess acetylene flame aids in welding but flux should be used to assist in removing oxide. A neutral flame is best for the thin walled castings.—*Oxy-Acetylene Tips*, April.

Making Sheet-Steel Barrels

Leading manufacturers of steel barrels today turn out their products on a straight-line production basis similar to that used by automobile manufacturers. The steel sheets to be fabricated are unloaded at one end, where they begin the journey over conveyors from press to press, progressing continually, being scarcely touched by hands, until completely painted and finished barrels are turned out at the other end on the shipping platform ready for delivery.

The production of steel barrels varies with varying types of barrels and with different fabricators, but fundamentally the process is the same. The typical seamless steel bilged barrel is drawn from one continuous piece of sheet steel. By successive pressing operations, the barrel is gradually formed. After it has reached the maximum diameter required, it is drawn so as to reduce the metal thickness and increase the length. It is then bilged by maintaining the metal thickness at the largest diameter and increasing the thickness toward each end. This is accomplished by a contracting or closing in on the ends.

The head of the barrel has a drawn flange with the open end of the shell curled securely around it. When this joint is dipped in molten metal it becomes securely knit together over the entire contact area between the head and the shell. After being galvanized or terne coated, both inside and out, it becomes rustproof.—*Making Markets*, April.

Machining Bakelite

Bakelite is non-hygroscopic, tough, strong and resilient. It is resistant to heat, cold, acids, oils, fumes and high electrical voltages. It is light in weight; yet moisture nor constant handling with oily and grease-stained fingers cannot warp or mar it. It resists wear well, and makes silent contact when used in moving parts. Its strength permits manufactured parts to be made thin, thus reducing clearances that would otherwise be necessary.

Bakelite may be machined like metals. When turning it in a lathe no lubricant should be used, and, whenever possible, it should be turned to size in a single cut. In any case the finishing cut should remove not less than $\frac{1}{8}$ in., else it will be difficult to maintain a uniform diameter. It should be turned at a peripheral speed approximately 25 per cent higher than cast iron, using a wide-nosed tool and coarse feed. The tool should have large clearance but no rake, and should be sharpened frequently.

Bakelite may be drilled with high-carbon drills without lubricant. Fast feeds should be employed. If the drill is centrally ground the hole will be true and smooth, but slightly undersize. To avoid sticking and overheating, the drill should be ground slightly off center. The drill should be withdrawn quickly. Ordinarily a drill can be used for half an hour before regrinding.

Hacksaws may be used to cut bakelite. When using band or circular saws the same speeds should be used as for hard woods. It will be necessary to sharpen and reset the saws frequently. When an exact cut-out of irregular outline is required it is better to drill closely spaced holes outside the scribed outline and cut out the material between the holes with a wood chisel. The part is then finished to the exact outline by hand or machine filing.

Punching is the most difficult operation to be performed on bakelite. A plain punch and die can be used on sheets $\frac{1}{8}$ in. thick, but smooth edges cannot be obtained on material more than $\frac{1}{16}$ in. thick. There must be minimum clearance between punch and die, and the tools must be kept sharp. A little oil may be used on the material or grease applied to the punch.

Threading may be done with ordinary taps and dies, using the same lubricants as upon metal. In milling bakelite, high speeds and coarse feeds should be employed, so that the cutter will throw the chips away from the work. If possible, all of the material to come off should be removed in one cut. No lubricant need be used.

A velvety finish may be obtained on parts made from bakelite by using coarse sandpaper, followed by fine sandpaper with oil.—*Machinery*, April.

Carbon Steel Grades for Tools

Carbon tool steels are graded according to carbon content, which usually runs in the regular grades from 0.60 to 1.40 per cent carbon, sometimes referred to as 60 to 140 "points." The low-carbon tool steels are more easily forged and machined than those having high-carbon content, but they do not harden to the same extent and are not as suitable for edged tools or dies. Each grade requires special treatment, the recommended uses and heat-treatments being as follows:

Carbon 0.60 to 0.70—A soft tool steel for tools on which a keen edge is not necessary, and which must withstand severe shock, such as:

Drop hammer dies	Shaft keys
Rivet sets	Valve links
Brick chisels	Set screws
Pick points	Tongs

Forge at a light cherry red, about 1,600 deg. F.
Harden at full cherry red, 1,410 to 1,450 deg. F.

Carbon 0.70 to 0.80—A general utility steel for purposes in which toughness must be combined with considerable hardness, such as:

Anvil faces	Shear blades
Blacksmiths' tools	Wrenches
Cold chisels	Bucket teeth
Mining drills	Rivet sets

Forge at a light cherry red, about 1,600 deg. F.
Harden at a full cherry red, 1,400 to 1,440 deg. F.

Carbon 0.80 to 0.90—A steel for use in tools that must combine hardness and toughness, as:

Ball peen hammers	Punches
Hot chisels	Vise jaws
Beading tools	Quarry drills
Spring steel	Hand chisels
Pneumatic hammer cylinders	

Forge at a light cherry red, about 1,600 deg. F.
Harden at a full cherry red, 1,390 to 1,430 deg. F.

Carbon 0.90 to 1.00—For use in tools combining hardness and toughness, as for example:

Cold heading dies	Spring steel
Pocket knife blades	Cant dogs
Machinists' hammers	Shear blades (small)

Forge at a light cherry red, about 1,600 deg. F.
Harden at a full cherry red, 1,390 to 1,430 deg. F.

Carbon 1.00 to 1.10—For use in tools combining hardness and toughness, in which hardness is a prime consideration, as for example:

Collets	Lathe centers
Axe bits	Molders' tools
Flat drills	Scythe edges

Critical temperature 1,350 deg. F.

Tempering Table

Temperature for 1 Hour F.	Temperature for 1 Hour C.	Color	Temperature for 8 Min. F.	Temperature for 8 Min. C.	Suggested Uses
370	188	Faint Yellow	460	238	Scrapers, brass turning tools, reamers, taps, milling cutters, saw teeth
390	199	Light Straw	510	265	Twist drills, lathe tools, planer tools, finishing tools
410	210	Dark Straw	560	293	Stone tools, hammer faces, chisels for hard work, boring cutters
430	221	Brown	610	321	Trephining tools, stamps
450	232	Purple	640	337	Cold chisels for ordinary work, carpenters' tools, picks, cold punches, shear blades, slicing tools, slotter tools
490	254	Dark Blue	660	349	Hot chisels, tools for hot work, springs
510	265	Light Blue	710	376	Springs, screw drivers

NOTE:—The long draw for one hour is preferred to the shorter period. An oil bath can be used up to a temperature of 500 deg. F., above which a fused salt bath should be used.

Forge at a light cherry red, about 1,600 deg. F.
Harden at a full cherry red, 1,390 to 1,430 deg. F.

Carbon 1.10 to 1.20—For use where hardness is a prime consideration, such as:

Ball bearings	Lathe tools
Cold cutting dies	Reamers
Drawing dies	Taps
Twist drills	Plug drills
Woodworking knives	

Critical temperature 1,350 deg. F.
Forge at a low, light cherry red, about 1,500 deg. F.
Harden at a full cherry red, 1,385 to 1,430 deg. F.
Small tools should be treated in oil.

Carbon 1.20 to 1.30—For tools in which hardness on a keen cutting edge is necessary, as for example:

Brass-turning tools	Reamers
File-cutting chisels	Granite chisels
Wire-drawing dies	Cabinet files
Wood-turning tools	

Critical temperature 1,350 deg. F.
Forge at a cherry red, about 1,500 deg. F.
Harden at a full cherry red, 1,385 to 1,430 deg. F.
Small tools should be treated in oil.

Carbon 1.30 to 1.40—For use in tools where a keen edge is of prime importance, such as:

Boring and finishing tools	Cutters
Wire-drawing dies	

Critical temperature 1,350 deg. F.
Forge at a cherry red, about 1,500 deg. F.
Harden at a full cherry red, 1,385 to 1,425 deg. F.
Small tools should be treated in oil.

For the data given we are indebted to The Midvale Company

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American Machinist

Editors: KENNETH H. CONDIT AND FRED H. COLVIN

Established 1877

A Way to Check Unemployment

THERE is a simple way to find out the extent of unemployment. It involves the cooperation of Chambers of Commerce or other organizations and industrial establishments in counting the number of applicants for work at a given time. Buffalo has shown the way.

The Industrial Relations Group of the Chamber of Commerce of Buffalo receives periodically reports from thirty-two of the chief plants of the city as to the number of people seeking employment between 7:45 and 8:00 a.m., on a specified day.

One of the recent checkings showed that in Buffalo statements of widespread unemployment have been exaggerated. The reports listed a total of 118 applicants. This number was to be compared with 700 reputed to have been unemployed.

Other advantages result from a checking method such as described. For instance, the Buffalo records showed that the thirty-two plants added 300 employees to the payrolls from the middle of February to the middle of March. The types of applicants were classified and the information made available to all of the plants.

A concerted movement in all localities along the lines described would provide data for an accurate national report. If, in spite of prosperity, there is an undue number of unemployed, the fact should be known that efforts toward adjustment may be made. Organizations that can take a census of unemployed are available—why not use them? If machinery centers want to begin the good work, the *American Machinst* will publish their summary reports. We have told about Buffalo—who will be next?

Personal Contact in Shops

PERSONAL contacts made possible by small sized shops are supposed to be a vital factor in maintaining harmonious relations between the employer and his men. As applied to the old time machine shop the inference was largely true. But it is one of those half-truths that can be, and is, very misleading.

If personal contact were all that is needed, harmony would prevail in the small shops of the needle trades and the building trades. But the reverse is true, for it would be hard to find more inharmony than exists at times in either of these trades.

Personal contacts have great value but they must be the right kind of contacts. It is not enough to know every man's name—how you use it and what you call him are what matters most.

Fruitless Competition

MAKING a machine as a side line may have one good talking point in that the making of parts can be considered filler jobs for the men and machines when they are not engaged on the regular work of the plant. But it also has its disadvantages, especially when machine tools are the side line. In this era of specialization, it seems that there still are innumerable machine builders who have regular lines that constitute the bulk of their business and on which they know their profits depend, but who hang on to other jobs that in the long run are net losses to them. These machines that are built at a loss then constitute difficult items of competition to other companies manufacturing the machines as regular product.

Naturally, any builder is inclined to think that the other fellow should be the one to drop the line. But there is only one true answer, and that is to run down the real costs on every separate product made in the shop, and throw out those jobs that are not the profit makers. If the facts can be ferreted out it will generally be found that there is no money made on machinery side lines, and that the so-called filler jobs are the most expensive items in the shop. Moreover, the time consumed by foremen and executives on filler jobs is seldom taken into proper consideration. Such time and effort would yield larger eventual profits if devoted to improving and producing the regular lines.

If the truth were fully realized, also, it would be seen that interferences with standard work by the side lines are as frequent as the chances to save waste by filling in with them. Honest cost analysis of any "extra" job in the plant, taking into consideration the costs of management, stock carrying, and other intangible factors, will result in the dropping of such unprofitable side lines, and the leaving of the way clearer for the realization of a fair profit by the companies that are making the machines as their regular production.

Pratt & Whitney Nos. 1 & 1A Jig-Borers

FOR small precision work, two jig-borers, Nos. 1 and 1A, have been introduced by the Pratt & Whitney Company, Hartford, Conn. These machines are similar to but smaller than the jig-borer of the same manufacture described on p. 808, Vol. 65, *American Machinist*. These machines were developed to drill, bore and ream holes in jigs, dies and similar tools, and to locate them exactly in relation to a given point of departure or to each other without recourse to measuring instruments other than those applied to the setting of the machine.

From the base a single column, rectangular in general shape, rises to support a vertically-sliding spindle head, speed and feed-change gear box, and the driving motor. A saddle is gibbed to slide horizontally upon the base in a direction to and from the column, and upon the saddle is a table capable of movement at right angles to it. By a combination of these movements a piece of work secured to the table may be positioned to bring any part of its surface, within the range of the machine, under the centerline of the spindle.

The movements of the saddle and table are actuated by hand-operated screws, which are depended upon only for positioning the work and have no part in measuring the distances traversed. For the latter purpose inside micrometers, end measuring rods or precision gage-blocks are employed in connection with dial indicators that are built into the machine.

Two such permanently located indicators, reading in increments of 0.0001 in., are provided. They are located in and protected by pockets cast in the machine members; one in the front extension bracket in which is the thrust bearing of the cross-screw to move the saddle, and the other at the right end of the saddle in similar relation to the traverse screw. Both pockets are closed by hinged covers except when the instruments are under observation. The stem of each indicator is opposed to an adjustable measuring anvil in the saddle and table, respectively. Directly beneath the measuring points thus represented in each case is a V-shaped groove, or channel, extending over the full range of movement of its respective part. An end measuring rod, gage block, or other accurate distance piece may be laid exactly in line with the measuring points, so that when the anvil of the saddle or the table, as the case may be, is adjusted to contact with the distance piece, any further movement of the part will be transmitted to the pointer of the indicator.

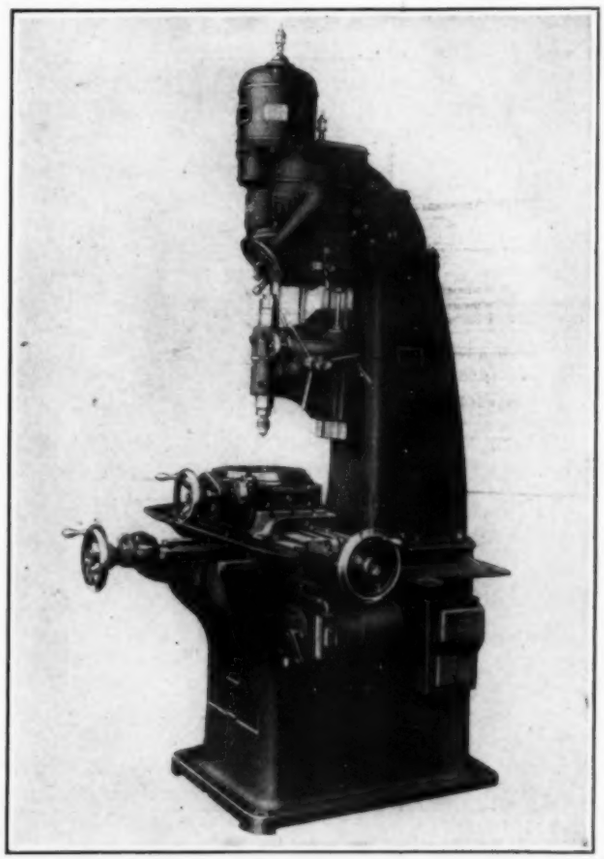


Fig. 1—Pratt & Whitney No. 1 Jig-Borer

The method of applying the measuring feature is as follows: Having established a point of departure, by layout or otherwise, and bored the first hole, the relative position of the second hole is determined by reading the dimension from the drawing and by triangulation if necessary. A measuring rod, or an inside micrometer adjusted to known length, is laid in one of the channels. The movable anvil is adjusted to bear against the rod or micrometer so that the spring of the dial indicator is put under tension, and the dial is then adjusted to zero.

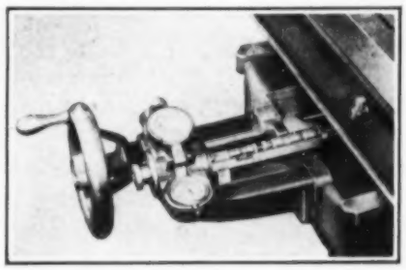


Fig. 2—View of transverse measuring slide with dial indicator

Any minute movement of the table or of the saddle, as the case may be, may now be read in increments of 0.0001 in. directly from the dial of the indicator. Longer or shorter movements are measured by substituting a rod of the desired difference in length, or by resetting the micrometer, and again bringing the pointer of the indicator to zero.

The difference between the No. 1 and the No. 1A machines is solely in the matter of height and weight, and a minor change in the position of the controls because of the increased height. The spindle is carried in a sleeve, or quill, that has a vertical range of 4 in. in the head which has a vertical adjustment of 5 in. on the column. The center of the spindle is 9¼ in. from the face of the column. The maximum distance from the working surface of the table to the end of the spindle is 10¾ in. in the No. 1 machine and 15¼ in. in the No.

1A machine. The minimum distances to the table are 1¾ and 5¾ in., respectively, and the working surface of the table is 9¾x18 in. The crosswise travel of the saddle is 10 in., and the longitudinal travel of the table is 18 in., while the traverse is 10 inches.

Vertical movement of the spindle quill is by means of a rack and pinion and three-spoked capstan for hand operation. Two geared power feeds of 0.002 and 0.005 in. per revolution of the spindle are possible in either direction. The quill is graduated in increments of $\frac{1}{16}$ in. over its entire range of movement.

The spindle is driven by a four-speed electric motor, mounted vertically at the top of the column. Four additional speeds are obtainable through back gears acting through clutches so that they may be engaged and disengaged without stopping the machine. Spindle speeds from 132 to 1,800 r.p.m. are available. All gears in the head are heat-treated and ground. Lubrication is effected by gravity and splash to all revolving parts from a central reservoir. Sliding members are oiled through cups located adjacent to the surfaces to be lubricated.

The No. 1 machine stands 95 in. high and occupies 58½x59 in. of floor space. The No. 1-A machine is 5 in. higher, but occupies the same space on the floor. The weights, including driving motor and all regular equipment, are 2,650 and 2,800 lb., respectively. Regular equipment includes the motor and drum-type control; two indicators, English or metric; two inside micrometers; two sets of end measures of 1, 2, 3 and 6-in. lengths; one ¼-in. round collet and one No. 1 Morse-taper collet.

Larson Straight-Line Polishing Machine

AUTOMATIC polishing of large, flat-surface articles such as bumper bars, molding strips, T-squares, etc., may be accomplished on the Larson straight-line polishing machine which has been developed by the Hanson-VanWinkle-Munning Company, Matawan, N. J., from the Larson rotary type. In addition to ordinary flat polishing, the design of this machine lends itself to other polishing and buffing operations through the use of lifting cams for irregular shapes, positive rotating fixtures for circular work, and automatic spinning fixtures for bolt heads, etc. In short, the flexibility of the spindle adjustment and the rigidity of the work platens permits many types of hand operations to be duplicated.

The carrier table consists of a series of cast-iron platens interlocked to form a solid table on which the work is set. These work platens are machined true and are mounted on adjustable hardened rollers. This adjustment insures perfect alignment of top surfaces of platens with each other and forms a base on which to fasten mechanical fixtures or magnetic chucks for holding the work in place. The rollers run on a track which maintains the platen tops at a constant level.

The polishing wheels are mounted on heavy steel spindles running in double bearings which in turn are mounted on heavy yokes controlled by compensating springs. This construction insures support of the heavy polishing wheel; permits uniform pressure of the polishing wheels against the work; and increases the life of the abrasives and wheels.

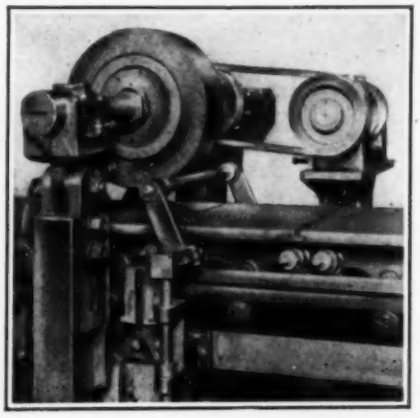


Fig. 2—View of polishing section with adjusting mechanism

The spindles are adjustable to any pressure and oscillate over the work. If desired, the oscillating motion may be eliminated on the last spindle in order to straighten the high-light marks. For all cutting operations, the polishing wheels spin in the opposite direction to that in which the work is progressing, but for the final finish, the last wheel may be rotated in the opposite direction so that the highest degree of finish may be obtained. The spindle yokes and the wheels may be set at various angles so that each succeeding wheel will polish or buff out the marks left by the preceding wheel by cutting across them. Any number of polishing wheels can be used as the machine is built on a sectional basis permitting a long or short delivery.

The movement of the table is controlled by pedals placed at both the delivery and receiving ends. The table may be quickly brought to a dead stop by means of either pedal.

Fig. 1—Larson Straight-Line Polishing Machine having three sections

When the table is started, the spindle head automatically lowers the polishing wheels to the work, and when the table is stopped, the wheels are automatically lifted.

When in operation the work platens carry the parts to be processed under the polishing wheels which are set at predetermined heights. Each wheel takes but a slight cut. By using three or more wheels the total amount of material removed at one handling is multiplied and production is correspondingly increased. The first wheel may be coated with a coarse abrasive, while the final or finishing wheel may be coated with fine abrasive, thus producing a proper surface for plating or buffing.

The polishing wheels may be run dry and supplied with hoods for connection to exhaust systems, or the wheels may be cooled by means of oil through the use of a coolant system with screened reservoir tank.

Polishing-wheel spindles may be driven by motor or overhead countershaft as desired. Tex-rope drive, with necessary pulley and motor platform can also be furnished. The Tex-rope motor drive will permit the spindles on which the wheels are mounted to be raised and lowered without reducing the tension.

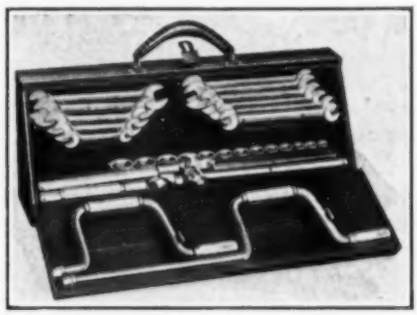
The platens travel at a normal speed of 12 ft. per min., but this speed can be altered to suit the various conditions. For average polishing, each head requires 3 hp. and the platen drive from 1 to 2 horsepower.

The machine occupies a floor space of 3x14 ft. and weighs approximately 4,500 lb. exclusive of motor, magnetic chucks, or other attachments.

Williams-Husky Combination Wrench Sets

Through a merchandising agreement, J. H. Williams & Company, Buffalo, N. Y., and the Husky Wrench Company, Milwaukee, Wis., have placed two combination wrench sets on the market. The No. 642 outfit shown in the illustration is known as the "Mechanic's Wrench Kit" and is suitable for garage use. The kit includes five Williams' "Superrenches" of either the engineer's or obstruction pattern, and having ten different openings from $\frac{3}{8}$ to $\frac{7}{8}$ in., six tappet pattern "Superrenches" with openings from $\frac{1}{2}$ to $\frac{7}{8}$ in., and thirteen "Husky" chrome-alloy steel sockets, sizes $\frac{7}{16}$- to 1-in. hexagon, with seven wrench handles, either $\frac{9}{16}$-in. hexagon or $\frac{1}{2}$-in. square section, as desired. The kit is fitted into a case made of No. 20 gage steel plate, finished in black lacquer, and the size is $20\frac{1}{2}$x$5\frac{1}{2}$x8 inches.

The No. 321 Williams-Husky "Economy" wrench set is a smaller assortment than the above, but is sufficiently comprehensive to meet average needs. The compact metal box measures $11\frac{1}{2}$x$5\frac{5}{8}$x$2\frac{1}{4}$ in. The set contains five Williams' "Superrenches" of either the engineer's or obstruction pattern, with ten different openings of $\frac{3}{8}$ to $\frac{7}{8}$ in., and ten "Husky" sockets, sizes $\frac{7}{16}$- to $\frac{7}{8}$-in. hexagon, together with six wrench handles of either $\frac{9}{16}$-in. hexagon or $\frac{1}{2}$-in. square section.

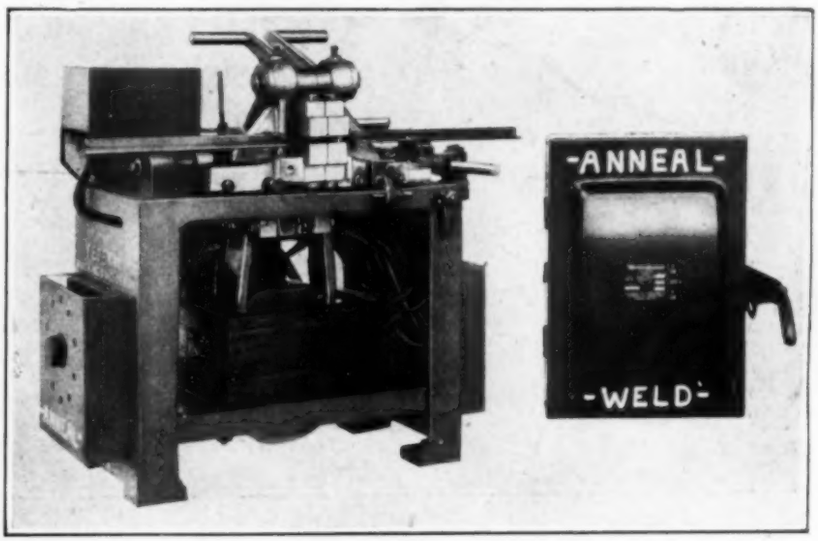


Williams-Husky No. 642 "Mechanic's" Wrench Kit

Federal Combination Bandsaw Welder and Annealer

THIS combination bandsaw welder and annealer has been brought out by the Federal Machine and Welder Company, Warren, Ohio. Formerly for the two operations of welding and annealing, the voltage regulator had first to be set at a welding voltage and then changed to the annealing voltage. This was a cumbersome procedure and frequently a source of mistakes. This machine does away with these difficulties, however, by providing a separate voltage regulator and a separator annealing regulator, as shown in the cut. The regulator on the left-hand side is used for annealing, while that on the right hand side is used for welding.

When the work is placed in the machine, a hinged stop placed back of the moving platen limits the back travel of the platen when setting up for the weld, and when swung out of place, permits an additional back travel, when annealing. The welding transformer receives its energy through a double-throw switch. When welding, the switch is thrown in the welding position, and when annealing, it is thrown in the upper or annealing position. This practice has eliminated resetting the bandsaw and reclamping the dies.



Federal Combination Bandsaw Welder and Annealer

Warner & Swasey Compound Cross-Slide for Nos. 3-A and 4-A Turret Lathes

EASE of operation and quick setting to any angle are the principal features of this compound cross-slide which has been placed on the market by the Warner & Swasey Company, Cleveland, Ohio. The device may be used for turning bevel-gear blanks and other similar work having steep tapers, and it also can be used for general work without loss of rigidity. Fig. 1 shows this compound cross-slide in use on a Warner & Swasey turret lathe.

The compound cross-slide is of massive construction, and has great strength and rigidity. The square turret, carrying the cutters, is made from a solid forging. The Warner & Swasey patented lock-bolt construction is used, so that it is not necessary to lift the turret off its seat for indexing. The swivel plate is made from a steel casting and is held securely to its base by four bolts. The cross-slide is held to its base by a square-lock construction so that the cross-slide, swivel plate and square turret are rigid even when the slide has traveled to the extreme end of its stroke and somewhat overhangs the base. The device does not interfere with using the full-swing capacity of the turret lathes, thus making the machine, so fitted, useful for general-purpose work. It may be used as a straight-turning and facing slide as well as a compound slide, and is securely held and locked in place by four bolts, two on either side of the slide. By locating the four binding nuts underneath the swivel base rather than above, the graduated dial on the compound base has been made narrower than is usually the case, thus giving the least amount of overhang to the cutters and preventing interference with the chuck jaws.

Angles can be faced or turned up to the full swing and capacity of the 3-A and 4-A turret lathes and the swivel plate can be rotated through 360 deg., the full-swing stroke of the slide being 8 in. It is also possible to use the standard taper attachment with this compound cross-slide. All graduated dials are large and of ample proportions, assuring quick and accurate setting of the clips.

Both the cross- and compound-slide have power feed, the construction and arrangement of it being such that it is impossible to engage both of these at the same time. The feed mechanism is of the worm-gear type. A worm gear of large proportions is mounted directly on a hardened and ground feed-pinion shaft which has both a bearing above and below the worm gear. Ball thrust bearings mounted on both sides of the feed worm are submerged in a bath of oil. With the rack and pinion construction, shown in Fig. 2, it is possible for the pinion to run entirely off its rack at either end of its stroke, thus providing a safety feature.

A large hinged oil cup at the front of the cross-slide provides a central oiling station. Wipers completely protect the dovetail from dirt.

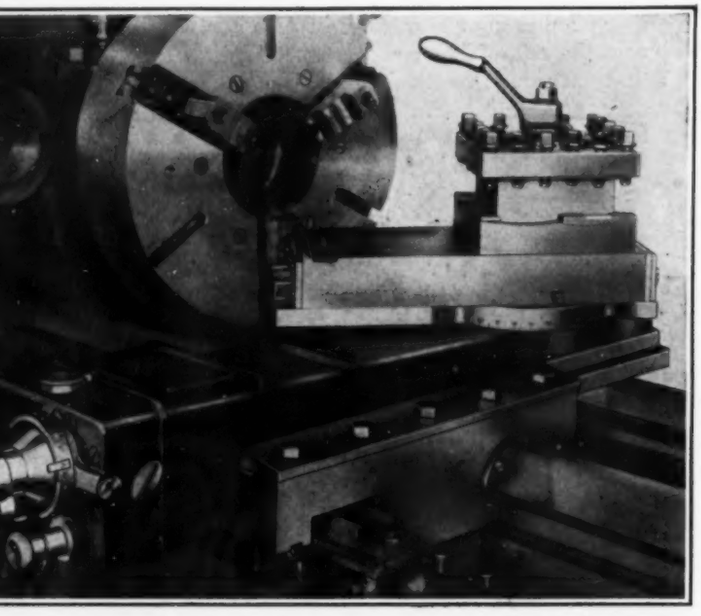


Fig. 1—Compound Cross-Slide applied to a Warner & Swasey universal hollow hexagonal turret lathe

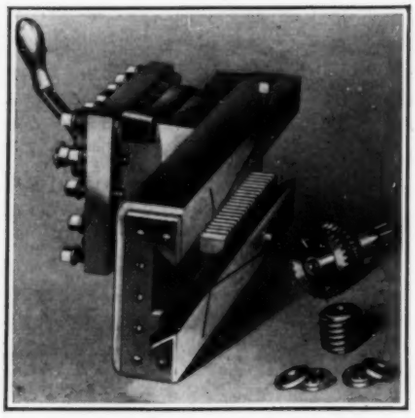


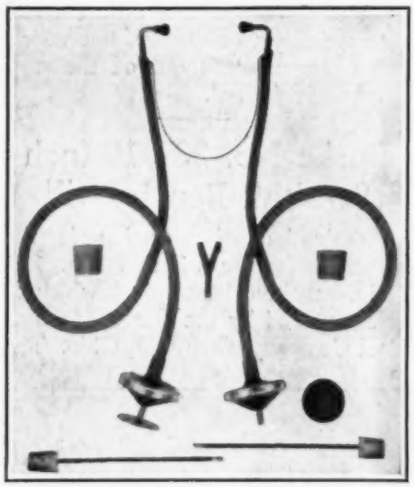
Fig. 2—Compound cross-slide showing worm-feed mechanism and ball thrust bearings

"Transmit-O-Phone" Sound Locater

To permit accurately locating the exact position of knocks in machinery the improved twin model "Transmit-O-Phone" sound locater, illustrated, has been recently introduced by the International Metal & Specialty Company, Berlin, N. J. The instrument consists essentially of a headpiece, twin amplifiers and connecting hose, together with vibration disks and sound transmitting rods. Corks are used to clarify and cushion the sounds.

The advantage of the two amplifiers over one, as generally used on instruments of this kind, is that the location of the knock is more readily determined and it permits the operator to distinguish two different sounds in close proximity to each other or to detect sounds from two different points at the same time.

Ear tabs are offset to fit snugly and evenly in each ear, and to keep out external sounds. The disks are



"Transmit-O-Phone" Sound Locater

used for locating light sounds and the rods with the cork tips for sharp or loud sounds. The Y-piece is used where one amplifier only is necessary to locate the sound.

National Air Filters for Compressors

Two types of air-filtering apparatus have been developed by the National Air Filter Company, Chicago, Ill. The cartridge-type filters illustrated take care of capacities ranging from 150 to 800 cu.ft. per min., while the semi-automatic "Simplex, Jr.," filter was designed in capacities from 800 to 2,500 cu.ft. per min. for medium-sized compressors.

The cartridge filters are of the drum type with the entire cylindrical surface of the drum covered with the filtering material. Mats of multiple-ply copper ribbons which have been immersed in oil do the filtering, and there is little possibility of small pieces tearing loose and getting into the compressor to cause trouble. A large storage base for dirt is provided by several layers of expanded metal which are placed over the copper ribbon mats. This construction considerably lengthens the periods between cleaning. The cartridge may be located at either the compressor or at some remote point.

Cleaning the cartridges is a simple operation, since they are light and can be unscrewed from their couplings on the compressor intake pipe, or wherever located, by means of a handle on the closed end of the drum. Merely placing the cartridges in a steam jet or in hot water cleans them, and immersion in discarded machine oil renews them quickly.

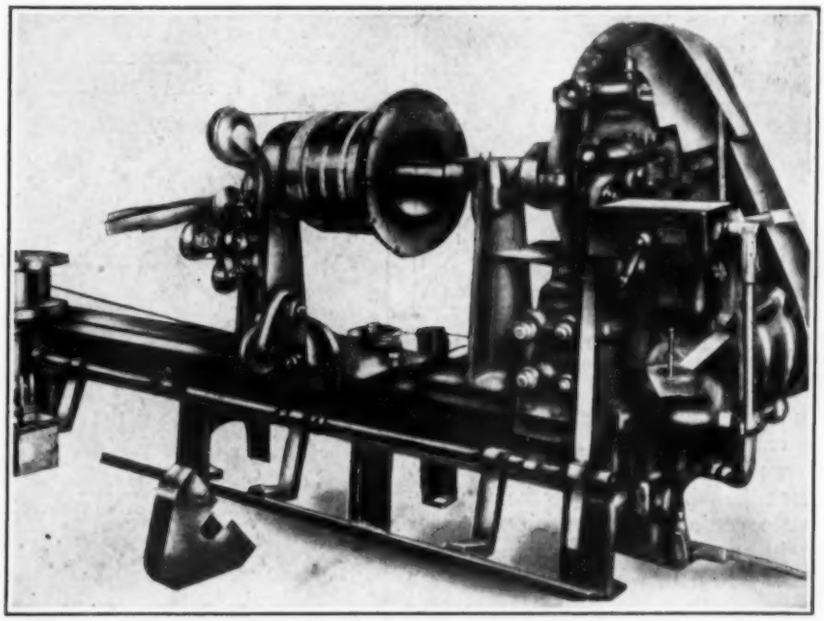
The Simplex, Jr., filter is semi-automatic in operation, the drum being rotated through an oil bath by means of a hand crank. The axis of the drum is horizontal, and one section of the filtering medium always rests in an oil reservoir placed at the bottom. At any given time air passes through four-fifths of the drum area, for only one-fifth is below the oil level being relieved of its dirt content by the solvent action of the oil. About once a week the drum is rotated one-fifth of the circumference by turning the hand crank. This action brings up one-fifth of the filtering area freshly cleaned and plunges the dirtiest one-fifth into the oil for cleaning. By means of a simple locking device on the handle, the drum can be locked firmly in any of the five positions. The sediment deposited in the oil falls into two sliding trays which are easily removed for cleaning. It need be disposed of only after several months.

National Cartridge-Type Air Filters showing method of connecting and the expanded metal outer coverings

General Electric Armature-Binding Wire Tension Indicator

For repairing haulage motor armatures, a binding-wire tension indicator has been developed by the General Electric Company, Schenectady, N. Y. This device indicates the exact strain or tension in pounds that is applied to the steel binding wire by the binding machine or lathe, and provides a simple means of keeping track of this tension throughout the full operation of binding up the armature. By its use, it is claimed, the binding wire will not be stressed beyond the elastic limit or tensile strength of the steel, and will be kept under uniform tension during the process of winding it in place.

The essential characteristics of the indicator are as follows: It can be applied to practically any type of armature-binding machine. It is equipped with a rotary dial which can be turned to any position by loosening a nut and setting the pointer at



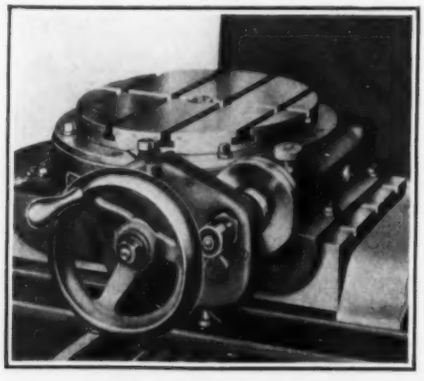
General Electric Armature-Binding-Wire Tension Indicator

zero so that the scale may be read at any angle. The indicator dial is accurately calibrated and graduated from 0 to 500 lb., allowing the use of any size binding wire within the range of the machine. One of the features of the indicator is that the center pulley wheel over which the wire runs is actuated by a heavy coil spring so that when the binding machine or lathe is started and stopped, a constant tension is maintained on the wire at all loads, so that the wires are prevented from loosening.

Rotary Table for Pratt & Whitney Jig-Borer and Other Machines

A rotary table for accurate indexing, primarily intended for use in connection with the Pratt & Whitney jig-borer, but suitable for work upon milling machines, has been brought out by the Pratt & Whitney Company, Hartford, Conn. The circular table is 12 in. in diameter. It is crossed on one diameter by a T-slot and at right angles to this by four similar slots, thus providing ample opportunity to secure work to it by means of T-head bolts. The circumference of the table is graduated in degrees around the full circle.

The table is rotated by a hardened-steel worm that meshes with teeth cut



Rotary Table for Pratt & Whitney Jig-Borer

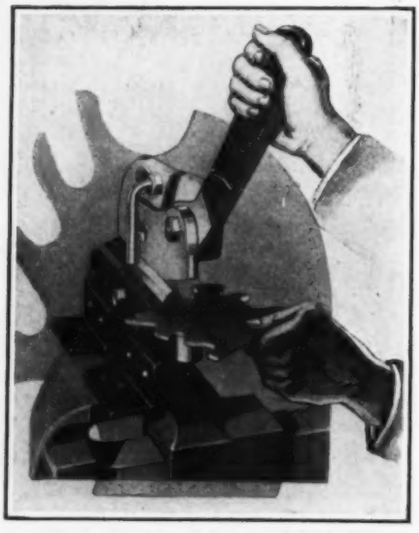
in the periphery of the table itself and is entirely inclosed. A handwheel of large diameter rotates the worm to turn the table quickly to the approximate setting, after which the finer adjustment is made by turning a small knurled knob, whose shaft carries a micrometer-graduated dial. By means of the dial, settings can be made within a few seconds of arc. Suitable binder bolts are provided to secure the table after the final setting is made.

The rectangular base is scraped flat on the bottom, and at the sides are deep flanges projecting downward to span the table of the machine on which it is used. When the device is removed from the machine and transferred temporarily to a bench or shelf it rests on the flanges so that the scraped surface does not come in contact with the rough bench-top, hence is not subject to injury by abrasion. The depth of the flanges is such that the handwheel swings clear when the device is so supported and there is thus no danger of breaking the wheel or bending the shaft.

"Handnib" Shear and Nibbler

A variety of templates may be quickly and easily cut by means of the "Handnib" shear and nibbler manufactured by the National Machine Tool Company, Racine, Wis. Very little filing is required on sheet metal cut by means of this device. The concave cutting knife shears along curved lines while a semi-circular punch cuts out the difficult corners. The device does not require mounting since it can be held easily in a vise.

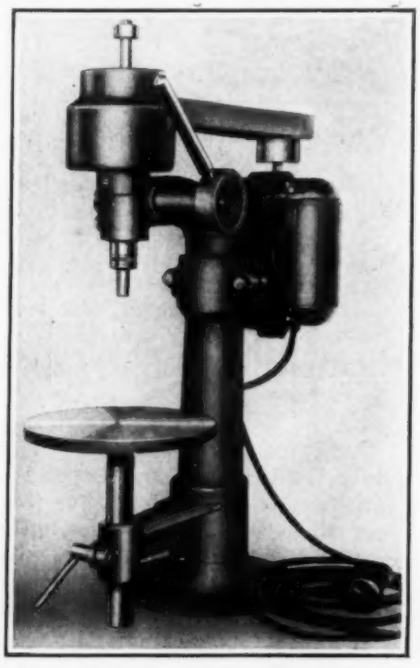
The shear blades are made of tool steel, and may be easily removed for sharpening. The length of blade is 4½ in., and has a capacity of shearing ⅛-in. flat stock and $\frac{6}{16}$-in. round stock. The clamping device consists of a taper latch which will adjust itself automatically to any vise, but which will swing upward out of the way when it is desired.



"Handnib" Shear and Nibbler

Burke No. 222 10-Inch Sensitive Bench Drill

Elimination of vibration is the principal feature of this No. 222 10-in. sensitive bench drill which is being offered by the Burke Machine Tool Company, Conneaut, Ohio. The motor bracket is of rigid construction and has slight overhang as is evidenced by the fact that the distance from the center of the spindle to the frame is 5⅛ in. This bracket also acts as the belt tightener. The energy is furnished by an electric motor built for tools of this nature. Speeds of 1,150 and 2,600 r.p.m. are obtained from a cone pulley.



Burke No. 222 10-Inch Sensitive Bench Drill

The spindle is tapered to fit either a ⅜-in Jacobs or Almond chuck, and is counterbalanced through the pinion. The pinion has a long bearing to which is attached a four-position handwheel. The vertical movement of the spindle is 2½ in. and the vertical movement of the table is 7 in., while the greatest distance from the spindle to the table is 9¾ in. The machine has a drilling capacity up to ⅜ in. The diameter of the table is 8 inches.

NEWS OF THE WEEK

Unemployment Figures Are Analyzed by Magnus W. Alexander at Metal Trades Convention

Problem of foremen training receives much attention

AFTER Magnus W. Alexander, president of the National Industrial Conference Board, speaking before the annual meeting of the National Metal Trades Association at the Hotel Astor, New York City, April 25 and 26, had finished his analysis of the unemployment figures announced by various agencies, and given wide publicity in the daily press, they shrank visibly in size and assumed the aspect of wild guesses. Mr. Alexander explained in detail how the estimates made by Secretary of Labor Davis, the Labor Bureau, Senator Shipstead and Senator Wagner, respectively, were arrived at and what the fallacies in the reasoning were.

All of the estimates were based on the census figures showing shrinkages in employment in the manufacturing industries between 1920 and 1927. No figures being available for other forms of employment, except railroads and coal mines, the percentage of shrinkage arrived at was applied to all employment and a completely erroneous result achieved. No account was taken of the shift from industry to industry or of the absorbing power of new industries. The only safe conclusion to be made is that no adequate statistics of unemployment are available.

Mechanization Not Responsible

Turning to the claim of Secretary Davis and of a certain school of writers of the "intellectual" type, that mechanization of industry is responsible for the present alleged unemployment, Mr. Alexander pointed out that, while mechanization of industry had undoubtedly made it possible for every workman to turn out more product in a day than before, thereby reducing the number of workmen engaged in factories, it could have had no effect on other forms of employment where it had no function whatever. On the contrary, mechanization of industry has so reduced costs and increased the standard of living that markets have been widened and industrial demand has been so stimulated that the men released have found work in new industries and there has been a call for 1,500,000 men in addition.

The address of Paul T. Norton, the retiring president of the National Metal Trades Association, outlined the accomplishments of the association in spreading the idea of the open shop and in maintaining good relations between employers and their men. The fact that only nine strikes have occurred among the entire membership in the past six years, speaks volumes for the efficiency and co-operation of both officers and members. Mr. Norton stressed the necessity for both apprenticeship and foremen training, the duty of employers to their men as to selecting the proper jobs for them, in providing good places

Harold C. Smith
New president of the National Metal Trades Association

in which the work, in maintaining harmonious relations, and in furthering the building up of morale and personal relations. He also mentioned the semi-annual wage reports as an excellent way of keeping posted as to prevailing wage rates in different localities.

Following this was the report of the treasurer and of various committees and an address by Walter Gordon Merritt on the efforts being made to change the present laws regarding labor.

The problem of training foremen was handled most interestingly by George Seyler, works manager of the Lunkenheimer Co., who selected twenty men to outline some of the things management expects of a foreman and also what foremen expect of the management. The main object was to show the advantages of getting men together to give their ideas, instead of preaching or lecturing at them. Among the things management expects of foremen, according to the men selected, are leadership, production at lowest cost, putting men at the jobs for which they are best suited, loyalty, fairness, discipline, ability to develop men, knowledge of his job, ability to plan his work, good health, open-mindedness, co-operation, ability to assume responsibility, to train an understudy, and to interpret company policy to men. He must not be a "yes" man.

Many of these same characteristics are also desired in the management, by the foremen, such as leadership, open-mindedness, co-operation, and the like, in addition such things as steady employment, human interest beyond the job, encouragement, opportunity for advancement and for self-expression, confidence, square deal, proper equipment, material and full information about the job. Mr. Seyler believes that men can iron out most of the troubles in a plant if they can be brought together and induced to voice their ideas, objections and suggestions. His experience along this line has been very successful.

Advantages of Budgeting

The advantages of industrial budgeting were outlined by Howard Coonley, president of the Walworth Co. He has found it advantageous to divide his products into groups and keep separate costs on each. This will show which items are most profitable and also those in which the turnover is too slow. He plotted the curve of his own business over a long period and, finding it followed the business curve of the Harvard Committee very closely, he naturally uses that as a comparison. In the same way he estimates sales for a year ahead and manufactures accordingly, checking the estimates each month so as to avoid too wide a variation.

Budgeting in this way has steadied the demand, and greatly reduced the company's labor turnover. It gives good cost control but should be flexible to meet changing conditions. Mr. Coonley feels that profits can be estimated in the same way, perhaps within 5 per cent as to volume and price. He considers it as necessary as time study and feels that business is at last becoming a science.

Harry W. De Bruin, works manager of the Jeffrey Manufacturing Co., delivered a paper on "Incentive Plans of Wage Payment for Foremen and Supervisors." To obtain maximum results, Mr. De Bruin maintained that it is necessary to have some wage incentive for the men who supervise the workmen in the shop. In doing this some plants

appear to pay a low salary and then give a bonus, which is in reality part of the salary. The majority, however, pay a fair wage, and then give periodic bonuses, giving the foremen an opportunity to share in the profits of the business. His company, he stated, has had the best results from training its own foremen, and then giving them incentives to work for.

Placing responsibility in the foreman can be recognized as one form of incentive. Another is the matter of continuous employment, and this one is important. "Continuous employment," said Mr. De Bruin, "depends on management, and even in times of depression the foremen have a right to expect that the management will provide them with employment." In regard to the wage form of incentive, Mr. De Bruin said that it was recognized that every good man desires to be in business for himself and that, therefore, every man who makes a direct contribution to the success of the company, such as a foreman, should receive some kind of monetary reward as his share of the success. Usually these rewards run from 10 to 40 per cent of the base salary, and are not a part of the salary. They are paid on tangible results, and include the items of waste, production costs, expenses, and other factors. It will not cover the situation if the foreman is paid simply on the increased output of his men. The system, however, must be simple enough so that it will be completely understood by the foremen. Incentive wage systems and foremen training go hand in hand, and it is necessary that the foremen be trained to understand the policies of the company to obtain maximum results.

Group Incentive Plans

The paper on "Incentive Plans of Wage Payment" prepared by G. Hetting, was read by Sterling Morkrum of the Morkrum-Kreinschmidt Corporation, in the absence of Mr. Hetting. The paper described the group system of incentive wage payment that has been used by the company for the last ten years, and showed how the foremen and supervisors also share in the bonus system in proportion to the increased earnings of the men under them. It also outlined the advantages that have been gained by the group system as applied in the company's plant. It has been found that there is now greater co-operation among the men, and that a group spirit is built up. New employees find it easier to break in, as they obtain the help of the other men in the group. It also aids in getting rid of incompetent men as the men in the various groups will not tolerate incompetency in the others. Mr. Hetting's paper pointed out that the wage incentive system brought with it the large plant overhead, but that this was offset by low unit-production cost. The Halsey system of payment is used, and the standard performance brings a 20 per cent bonus. One week is the unit used in computing the bonus. The system is built on accurate time study, and the differential in base rate regulates the larger bonus to skilled workmen and foremen.

The annual banquet was one of the largest in the Association's history. Hon. Charles Nagel, of St. Louis, former secretary of Commerce and Labor in President Taft's cabinet, spoke on the subject of "The Majesty of the Law." Dr. Samuel W. Grafflin, of New York, in his address "The First Principles in Business," sounded the keynote of modern business ethics. Some of his remarks are quoted in the accompanying box.

Harold C. Smith, president of the Illinois Tool Works, was elected president of the Association at the Thursday session. Other officers elected were: J. G. Benedict, Landis Machine Co., first vice-president; Jacob D. Cox, Jr., Cleveland Twist Drill Co., second vice-president; J. W. O'Leary, Arthur J. O'Leary & Son Co., treasurer. The following were elected councilors for two years: J. H. Van Alstyne, Otis Elevator Co.; H. C. Beaver, Rolls-Royce Co. of America; J. C. Spence, R. J. Russell, Century Electric Co.; Theodore Trecker, Kearney & Trecker Corporation, and Paul T. Norton, Case Crane & Kilbourne Jacobs Co.

Seven Fundamentals of Successful Modern Business

1. Courage to pioneer
2. Will to investigate
3. Capacity for new truth
4. Tolerance of radical young people, while we hold steady
5. Sense of responsibility
6. A set of great business convictions
7. Great sacrificial persistency.

Presented by Samuel W. Grafflin in an address before the National Metal Trades Association.

Materials Handling Problems Discussed by A.S.M.E. at Philadelphia

Bulk handling, exterior handling, interior plant handling, pneumatic handling, hydraulic handling and every other type of handling came in for attention at the two-day meeting staged, April 23 and 24, in Philadelphia at the Benjamin Franklin Hotel by the Materials Handling Division of the American Society of Mechanical Engineers.

At the general session on the morning of the first day, Frank D. Campbell presented a paper on "Materials Handling Methods at the Eastern Steel Castings Co.," of which company he is chief engineer, and H. A. Hoffer, eastern sales manager of the U. S. Cast Iron Pipe & Foundry Co., discussed materials-handling features of the De-Lavaud process of making pipe. A motion picture of the process concluded the session.

The afternoon was devoted to plant visits, and an informal dinner was held in the evening, at which the speakers were C. D. Young, general purchasing agent, Pennsylvania R.R., and Edward J. Mehren, vice-president, McGraw-Hill Publishing Co., Inc.

The general subject of the Tuesday morning session was materials handling in the transportation field. G. C. Woodruff, New York Central R.R., spoke on the railroad phase of the problem giving particular attention to the "L.C.L." container, and Willard C. Brinton took up the steamship angle as it exists in foreign trade. F. J. Scarr, Scarr Transportation Service, was to have delivered a paper on store-door delivery by motor truck but was prevented by illness.

Two sessions were held in the afternoon, one on bulk handling, the other on interior handling. In the evening, the subject was mechanization of coal mines and most of the discussion centered on that topic.

U. S. Chamber of Commerce Plans Annual Meeting

Current manufacturing problems, such as labor conservation, excessive competition, over-production and shrinking profits, will be discussed at the sixteenth annual meeting of the Chamber of Commerce of the United States, to be held in Washington on May 7 to 11. Discussion of these subjects and others of interest to manufacturers will take place at a special group meeting under the direction of the National Chamber's department of manufacture. Leading manufacturers from all parts of the country have been invited to attend and take part in the discussions.

"Teamwork for Profits in a Consumers' Market" is the subject of an address to be made by E. J. Mehren, vice-president of the McGraw-Hill Publishing Co. In discussing this question Mr. Mehren is expected to show that although circumstances apparently greatly favor the consumer it is possible for the manufacturer, by intelligent study and handling of the situation, to place himself in a position where he will be on equal terms with other manufacturers.

"Forecasting and Planning, Vital to Industrial Prosperity" will be presented by Donaldson Brown, vice-president of the General Motors Corporation. It is expected that Mr. Brown will emphasize the need for a dependable statistical picture of what is taking place in industry to prevent over-production and stupid competition.

The human relations situation in industry, including such questions as unemployment, the elimination of workers by labor-saving machinery, and the need for better trained workers and supervis-

ors, will be the third subject discussed before the manufacturing group, by C. S. Ching, manager of the employment division of the United States Rubber Co., and president of the American Management Association. The title of his talk will be, "Labor Conservation—Teamwork for Lower Costs of Production."

Gray Iron Institute to Formulate Policy

The principles enunciated at the organization meeting of the Gray Iron Institute, held in Pittsburgh, March 13, will be submitted for general discussion at a meeting to be held in Philadelphia on May 18, the last day of the American Foundrymen's Association convention. These principles include: the promotion of sound business ethics, the collection and distribution of information, the study of new methods for merchandising gray-iron castings and the stimulation of new uses of this product, the promotion of uniform cost accounting, the furtherance of research work, and the establishment and maintenance of standards of quality. These various articles are designed to remedy some of the evils that confront the gray-iron branch of the castings industry today. The meeting will be held in the Philadelphia Commercial Museum and will be called to order by B. H. Johnson, temporary chairman. Dan M. Avey, 1213 W. 3rd St., Cleveland, Ohio, is temporary secretary.

Kaempffert to Head Chicago Industrial Museum

Waldemar Kaempffert, science and engineering editor of the *New York Times*, has been appointed director of the Chicago Industrial Museum, which will occupy the fine arts building of the 1893 World's Fair. The museum, made possible by a gift of $3,000,000 by Julius Rosenwald and $5,000,000 given by the South Park Commissioners for reconstruction of the building, will house a well-planned display of engineering and industrial exhibits. The plan for the museum was conceived by Mr. Rosenwald after a visit to the famed Deutsches Museum in Munich.

Waldemar Kaempffert was born in New York and is a graduate of the College of the City of New York and of New York University. He was managing editor of the *Scientific American* for many years and later editor of *Popular Science Monthly*. He is chiefly known as a contributor to American and European periodicals on scientific, engineering and industrial topics and is the author of a two-volume history of American invention and of a history of astronomy. Mr. Kaempffert will pass several months in studying the museums of Paris, London, Vienna and Munich before taking up his duties in Chicago.

Competent engineers and scientists will be appointed as curators. It will be the task of these men to survey the historical development of engineering and industry and then to specify what exhibits must be obtained or constructed in order to show the evolution of modern civilization from ancient times to the present.

Machines will be cut away and shown in operation, so far as that is possible. Moving pictures will reveal the part that the machines play in the factory. A lecture hall will be provided in which engineers and qualified scientific men will give popular addresses. A floor area of about 400,000 sq.ft. will be available for the purpose of the museum.

Foremen Plan Fifth Convention

The fifth annual convention of the National Association of Foremen will be held in Canton, Ohio, on Friday and Saturday, May 25 and 26. A very extensive program has been planned, including visits to the Massillon, Ohio, plant of the Central Alloy Steel Corporation, the plant of the Hoover Co., manufacturers of electric cleaners, at North Canton, the Pennsylvania Railroad shops, and the plant of the Timken Roller Bearing Co. in Canton. Also the highly-developed trade and vocational McKinley High School will be opened to foremen visitors.

On the first day F. A. Seiberling, president of the Seiberling Rubber Co. and founder of the Goodyear Tire & Rubber Co., will speak on "The Requisites of the Foremen of Tomorrow." A. B. Segur will speak on "Conservation of Man Power Through Motion Analysis," and W. Chattin Wetherill, of the University of Pennsylvania, on "Industrial Waste." After the close of the first day's meeting there will be a banquet, and entertainment, after which the meeting will be re-convened for the introduction of the new officers and address by H. W. Hoover, president of the Hoover Company.

The speakers for the second day, will be Mr. J. C. Wright, director of the Federal Board for Vocational Education, on the subject of "Foremen Conferences," and Robert H. Spahr, of the U. S. Chamber of Commerce, on "The Foreman as an Executive."

Standards for Tungsten Hack-Saw Blade Adopted

A simplified practice recommendation for standard tungsten and carbon hack-saw blades was adopted at a general conference held April 12, 1928, at the Department of Commerce, Washington, D. C., by manufacturers, distributors and organized users of the commodity, in co-operation with the Division of Simplified Practice. The conference set July 1 as the date on which the recommendation shall become effective for new production, and January 1, 1929, as the effective date for clearing current stocks. It was agreed that the specification of the Federal Specifications Board for this commodity will be brought into conformity with the simplified practice recommended. This program does not apply to what is known as high-speed blades.

The conference appointed the following standing committee: William P. Jeffery, managing director, Hack Saw Manufacturers Association, to represent the manufacturers; Lawrence G. Puchta, National Supply & Machinery Distributors' Association, to represent the distributors; F. S. Walters, the American Society of Mechanical Engineers, also Westinghouse Electric & Manufacturing Co.; F. C. Nichols, the Navy Department, and a representative to be appointed by the American Railway Association, to represent the organized users. This committee will be responsible for periodic re-surveys to determine the degree of adherence and to recommend such revision as conditions may warrant.

The recommendation, as adopted by the conference, represents a reduction of approximately 75 per cent in variety. The Department of Commerce will publish the recommendation when acceptances have been received from manufacturers representing 80 per cent of the product.

Simplified Practice Recommendation for Coated Abrasive Products Adopted

A simplified practice recommendation for coated abrasive products was adopted at a general conference held April 11, 1928, at the Department of Commerce, Washington, D. C., under auspices of the Division of Simplified Practice. This recommendation provides that certain sizes and varieties of abrasive paper and cloth will be manufactured as stock items after September 1, 1928, which will, according to estimates given at the conference, care for at least 95 per cent of the trade. The conference set the first revision date for the recommendation for July 1, 1929, and allowed until January 2, 1929, to clear the present manufactured stock. The present Federal Specifications Board specification for coated abrasive products conforms with the recommendation adopted.

Conference on Steel Treating at Purdue

The second annual conference on steel treating is planned at Purdue University, Lafayette, Ind., May 10-11, under the direction of the engineering extension department and the department of practical mechanics and in conjunction with the local sections of the American Society of Steel Treating. The two-day program will be devoted to the fundamental problems of steel treating, and the discussion will include such topics as the manufacture of iron and steel, alloy steels, carburizing, quenching high-speed steel, stainless and heat-resisting steels, heat-treating furnaces, malleable castings, methods of determining critical temperature of steel, and microscopic analysis.

The Business Barometer

The outlook in Commerce, Finance, Agriculture and Industry

By THEODORE H. PRICE

Editor, Commerce and Finance, New York

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BUSINESS is unfortunate in that the statistics upon which it must depend deal chiefly with conditions that are from one to eight weeks old. Bank returns are perhaps an exception to this statement, but loans and deposits usually reflect the consummation of business that was initiated some time previously, and bank clearings have ceased to be significant of the commercial trend because they now include the enormous payments made for stocks and bonds.

Freight car loadings furnish about the only gage of the very recent past that is available, and their statistical value is somewhat impaired by the increase in motor truck traffic and by the decrease in coal tonnage which is due to the greater use of oil and hydro-electric power. Therefore it is exceedingly difficult to say whether the business revival upon which the stock exchange has been counting is in sight.

In the agricultural states of the West and South, sentiment seems to be more optimistic. But although we ought to be thankful that hopefulness is normal it must be admitted that there is not much in the record of the last few weeks to indicate a gain in the volume of trade or an increase in the consumer demand. Car loadings for the week ending April 14 are 4 per cent under last year and 6 per cent less than in 1926. Railroad gross earnings show a corresponding decline, and overproduction is still complained of in many industries. This is particularly true of cotton textiles, which are moving but slowly despite the advance in raw cotton and the strike that has closed most of the New Bedford mills.

Reviews of the steel trade speak of a seasonal let-down, a lightening of the pressure for deliveries, and weakening prices. Commercial loans as reported by the member banks of the Federal Reserve System fell off last week after rising for the past two or three months, and money is still in abundant supply, although the Federal Reserve Banks at Richmond and Minneapolis have followed the example of Boston, Chicago and St. Louis in raising their discount rates to 4½ per cent.

But the speculative markets have continued to ignore the comparative listlessness of trade. Wheat, corn, oats and rye have made new high records for the present movement, cotton has advanced sharply and most of the other less conspicuous commodities have shown themselves more susceptible to bullish than to bearish news.

Early in the week the stock market seemed hesitant, but it soon recovered itself, and some sensational advances in the railroad shares were recorded on Wednesday. As usual the buyers in each market have been actuated by special developments. In grain and cotton it was unfavorable crop news, and on the Stock Exchange it was the talk of railroad consolidation. But the fact that nearly everything went up indicates that the area of speculation is widening, and that it may soon include the entire territory of business. This will become inevitable if the great staples continue to advance, with a consequent increase in the cost of living that will compel wage earners to demand more pay. This demand, if granted, will add to the cost of production, and give another twist to the vicious spiral, which will continue to tighten until something breaks. Meanwhile everyone will be happy as long as prices continue to advance, for the illusion that high prices mean prosperity is almost universal, and the only persons who do not share it are the old-fashioned economists who continue to believe in the law of supply and demand.

But it is conditions rather than theories with which practical business men are concerned, and there is no denying that the public is now more inclined to buy than to sell. As long as this attitude is unchanged the trend of prices will be upward, and most speculators find it exceedingly difficult to sell on a rising market.

This is the broader view of a situation that is almost unique, for never before has the relation between finance and commerce been as close as it is today. Merchants used to buy for six months in advance. Now tomorrow's requirements are bought today, and orders are closely adjusted to the current demand and the present mood of the ultimate consumer. Therefore a continued advance in the prices of grain and cotton may soon bring about the expansion in distributive trade that has been for so long expected. Upon this assumption it seems safe to act, while still observing the stock market, where the first signs of a change in sentiment will probably be visible.

In Europe, as in this country, the constructive spirit appears to be in the ascendent. Winston Churchill's announcement that the British Government would favor producers by reducing their taxes is highly applauded by the industrialists of England, and Poincare's victory in the French elections is interpreted as a triumph for sound finance. There is, in fact, much to encourage the belief that Europe is "coming back" with great rapidity, and that her competition will soon be keenly felt in all the markets.

The "cigarette war" that has been started in the United States because a British tobacco company has attempted to enter the American field is an example of the competition referred to as is the struggle between certain American and European oil companies for supremacy in the Far East.

WHAT'S DOING IN INDUSTRY

A SLIGHT falling off has been noted in machinery and machine tool sales in the past week in several centers. This situation in every case is more a hesitancy on the part of buyers to close orders than a decline in metal-working activities, since inquiries are still found in good volume. In New England, for example, where closings are slow, inquiries are numerous and there has been a steady improvement in industrial conditions. In Cincinnati, also, there has been a slight decline in sales, but there are enough orders on hand to keep most of the tool manufacturers busy for some time.

AUTOMOTIVE business has been increasing from week to week in Indianapolis and Detroit, but in the latter case, and in Michigan in general, prosperity is not limited to the automotive shops alone. In the South, also, general industrial conditions are better than was predicted earlier in the year. Textile equipment sales have been equal in volume to those of last year, where a recession has been expected. Contractors' equipment is going well here, but adverse weather has affected building equipment sales in other centers, such as Indianapolis.

IN MACHINE tools, the chief activity is in single items of the medium-duty type. Heavy machines are finding no market, and railroad buying is slow, except in Chicago, where orders from this class of consumer have increased. Canada continues to report a steady upward trend in all branches of the metal-working industry, and large building projects are under way.

The Industrial Review

Weekly progress of the machinery and machine tool business

THE following reports, gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

SOUTHERN DISTRICT

Demand for machinery, machine tools and mill supplies in the last two weeks showed further improvement in the southern district, according to dealers and distributors in Atlanta, who are finding business as a whole about as good as it was at this time last year, which is better than had been expected early in the year. Furthermore, from inquiries now on hand and reports from salesmen in the field, there is every promise that sales will continue satisfactory.

Woodworking equipment continues well in the lead, as has been the case the last six or seven months. Sales are the best they have been at this period in four or five years. Primary buyers include furniture factories in the Georgia, Carolina and East Tennessee territory, with millwork plants also active in this district and fair to good sales with planing and sawmills.

Textile equipment sales are larger than had been expected and about on a par with those for the corresponding period last year, as this industry is doing a considerable amount of new construction in the South this season, especially in the Carolina, Georgia and Alabama districts.

Contractors' equipment is moving well and the late spring and summer outlook is considered very promising. Road building equipment orders have been heavy the past month in most southeastern states, fully as large as they were at this period in either 1926 or 1927. Smaller machine shops and garages, however, are not buying as actively as last year, and most sales reported are of used or rebuilt equipment. Railroad equipment orders for new shop projects continue fairly satisfactory.

INDIANAPOLIS

Little improvement is seen in the machinery business here. In fact, during the past two weeks some lines seem to have been a little more quiet. The volume is what might be expected, however, in view of general conditions, and the trade is not considerably worried. The last week has seen a resumption of inquiries from several sources, lending encouragement to the general situation.

The automobile trade is buying, and its needs are increasing from week to week. Several factories in the state are putting more men to work, and increasing production rapidly for the summer season. This is particularly true of Marmon and Chrysler. Purchases by the accessory manufacturers also are increasing rapidly, particularly in tools. Body plants in Indiana are working to capacity, some of them overtime, and the demand for special machinery is good.

Demand from the steel industry, however, continues rather low. This is thought to be temporary, since some inquiries have been received that would indicate rather heavy buying shortly. Demand for machinery and tools from the farm implement factories has fallen down materially since the close of winter, and this source of demand will likely be quiet the remainder of the summer.

The building demand has not opened up as much as the trade would like, but weather conditions have had much to do with this. There is a fair demand, however, for road-building machinery, now that the first state contracts have been awarded, and the various counties are preparing for early road-building programs. Demand for garage equipment shows some improvement. Used machinery dealers say that business is only fair. Some sales are being made, of course, but the volume is unsatisfactory. Railroad demand is somewhat spotty, and it is doubtful if much business will be done with these utilities during the present spring.

DETROIT

With all of the automobile plants and all of the many associated industries running at top speed, the era of prosperity for machinery trade that began late in December is not only holding its own, but is showing a noticeable improvement in some cases.

The total sales for April will equal or perhaps exceed, the March total, which was very high. Deliveries, which have been far behind the orders, have not yet made much progress. In some lines it is possible to get quick delivery, but this is rather the exception than the rule, and dealers are now spending more time fighting for deliveries than in getting orders.

There is no doubt that the prosperity of Detroit, and all of Michigan, is quite general and is by no means limited to the automotive industry. But this industry is still the index of conditions.

Moreover, it is felt that when the Ford Motor Company gets into its full stride things will show a decided improvement. Ford is now turning out more than 2,000 cars a day. He is letting out a great deal of work on contract and is pushing his own plant as rapidly as possible in order to cut down the huge bulk of unfilled orders that has steadily piled up. All of the other plants are turning out cars and accessories as rapidly as their facilities permit and most of them are making purchases for inquiries.

CINCINNATI

The majority of the machine tool manufacturers in the Cincinnati district report a slight falling off in sales in the past week. However, there are some who report that they held their own and a few report a slight gain, among the latter being a maker of large tools. Selling agents report that they held their own, although the market was rather sluggish in local territory.

Manufacturers report that a good volume of inquiries came in during the week, but these did not include any lists of importance. The week's bookings were almost altogether confined to single tools and replacements, ordered by general machinists and miscellaneous users, located in all sections of the country. The few purchases made by concerns in the automotive industry and allied trades also were confined to single tools and replacements, and the same was the case with railroads.

Neither manufacturers nor selling agents are of the opinion that the lull of the past week is a sign that a continued and general business recession is to take place. It is reported that selling agents in northern and eastern territory have in the past few days closed considerable business which soon will reach manufacturers in the Cincinnati district. Orders now booked will sustain manufacture for some time.

CHICAGO

A majority of machine tool dealers and builders report that the tide of business has receded to a small degree during the closing days of April, and that the month will fall a little behind March in the total volume of trade. As last month was an exceptionally active one in most lines of machine tools, however, a fairly good average of sales will be shown for the first four months of this year.

The decline noted has been largely confined to business in tools of the heavy-duty type, the demand for ordinary industrial and machine-shop equipment, especially electrical and machinists' tools, having been well maintained. Dealers handling used tools exclusively report trade as fairly active, and that good prices are being had.

Railroad buying has shown some improvement: the Rock Island, the Burlington and the Union Pacific have placed some good orders, though not of budget proportions. The Santa Fe is reported as expecting to issue lists additional to those already in the hands of the trade. Farm machinery and tractor builders still are active in the market for diversified shop equipment.

NEW ENGLAND

New orders placed in the New England section during the week would not be a true barometer of actual conditions within the machinery and machine tool industry, nor has it been throughout the month of April. The percentage of builders on short schedules has decreased from month to month since the first of the year; while the industry as a whole has made more progress than through the corresponding period a year ago.

Inquiries during the week included a good list from a large electrical manufacturer, and there are still impending items of equipment for the metal-working industry on which action has been postponed. The Middle West provided additional activity for machine manufacturers in Connecticut and Massachusetts by placing orders for high-priced equipment, including 12- and 14-in. vertical shapers, two die sinking machines, a vertical drill, a 13- and a 16-in. lathe.

Prospective business continues promising despite a shortage of orders from the steel and railroad industries. Closings on prospective orders are slow, and the tendency to prolong decision on outstanding lists seems to increase.

CANADA

A steady upward trend is notable in practically every branch of the metal-working industry in Canada. Sales of machinery and machine tools during the last couple of weeks have shown marked improvement; conditions in the automotive industry are more satisfactory, and the leading iron and steel plants are working at or near capacity. The most pronounced recovery in employment during the month of March was in the iron and steel industry. Production of steel ingots and castings during March, at 118,258 tons, was 20 per cent over the 98,820 tons produced in February, while the output of pig iron amounted to 78,390 long tons, an increase of 22 per cent over the 64,691 tons of February. These gains will be further increased by the blowing in, on May 15, of the reconditioned and enlarged furnace of the Canadian Fur-

nace Company at Port Colborne, operating on foundry pig iron.

Prospects for the agricultural machinery and implement industry this year are decidedly promising. Inquiries received by western Canadian implement houses during the past month have been more numerous than in other years. Furthermore, the type of inquiry is more satisfactory, the majority of farmers being ready to pay cash for supplies, whereas in other years the signing of notes was the usual custom.

Considerable importance is being attached to the building and other construction prospects for the current year. Very large projects are now under way throughout the Dominion, involving a capital outlay in excess of $85,000,000, in addition to which probably a further $100,000,000 will be expended on minor construction work during the coming season.

Inquiries for mining machinery and equipment are numerous, and present indications are that there will be a heavy demand this summer from the northern Manitoba and northwestern Quebec areas. Mining activities in Nova Scotia are also on the increase.

NEW YORK

Only one dealer in machine tools in the Metropolitan district expressed the fear that business was letting up. One other admitted that while the last week had been under par, April as a whole was turning out to be just as good as March, one of the best months in years. There is every indication, too, that conditions will remain good for some time, at least until the usual summer recession.

The high light of the past fortnight has been the purchases of the General Electric Co., said to amount to about $150,000. Most of the equipment is to go to the Pittsfield plant to handle increased production of the household refrigerator. The International Motor Co. is also said to be steadily increasing production of trucks at its Plainfield plant. A temporary lull in buying by the Wright Aeronautical Co. is evident, but it is expected that considerable buying will take place after the middle of May, when inquiries will go out for the equipment of a plant addition now under construction. Anti-friction bearing companies are also said to be active and to be buying equipment. Among such firms are mentioned the Federal Bearings Co.; the Hyatt Roller Bearing Co., preparing for increased production in railway bearings; and the Roller Bearing Co. of America, recent purchaser of the Mercer plant in Trenton.

The bulk of sales is still in single tools of medium-duty type. No heavy equipment is being sold, to any extent, nor is there any buying by railroads. The Bethlehem Steel Co., however, bought four Gisholt turret lathes for its Bethlehem plant, and five rebuilt lathes were sold to a company in Baltimore. The Standard Oil Co. bought two 36-in. and four 14-in. "American" lathes for export. Other machines sold for export included a 3-ft. radial drill, a 14-in. by 12-ft. lathe, a Smith & Mills shaper and six "Crescent" woodworking machines. Five Cincinnati centerless grinders and some Cincinnati-Bickford radials were also sold in the past week.

An indication of general activity in machine tool purchases throughout the country is given by the list of tools sold by the Pratt & Whitney Co. This list included 25 tool-room lathes ranging in size from 13 to 20 in. Four of them went to a company in Illinois, two to a shop in Indiana, and four to the Pratt & Whitney Aircraft Co. Three 6-in. vertical shapers were named: one went to an automobile company, and another to an electrical manufacturer. This last concern also bought a No. 3 bench miller and a No. 2 jig borer. Another jig borer went to a company in Cleveland. The Michigan Central R.R. bought a single-spindle centering machine, while an automobile concern in Michigan ordered seven production hand millers. Several grinders were named; two cutter grinders, and two 14-in. vertical cutter grinders. A 3-spindle Sigourney drill concluded the list.

Alexander W. Copland Dies

Alexander W. Copland, president of the Copland Gear Lapping Syndicate, of Detroit, died on April 23 at his home near Birmingham, Mich., at the age of 60 after a long period of illness. Mr. Copland first became known several decades ago when he invented a cake-baking machine which revolutionized previous methods of baking. He was then manager of the National Biscuit Co. plant at Cincinnati, where he devoted himself to the production of baking machinery. During the World War he served on the truck standardization committee. Two years ago he retired from the Detroit Machine Gear Co. to form his own company which he headed at the time of his death. He had just perfected an accurate gear lapping machine.

Alexander W. Copland

Welding Society Meets

Continued progress in the art of fusion welding by the gas and electric processes was made evident by papers, discussions and committee reports at the Annual Spring Meeting of the American Welding Society, held at the Engineering Societies Building, New York City, April 25, 26 and 27. This progress, it was shown, is mainly in the perfecting of technique, the establishment of preliminary standards for qualifying welders and supervising their work and the advancement of the test programs for welded pressure vessels and steel structures.

The election of the following officers for the ensuing year was announced: President, F. T. Llewellyn; senior vice-president, A. E. Gaynor; divisional vice-presidents, Ernest Lunn, J. W. Meadowcroft, H. P. Peabody; directors at large, A. M. Candy, J. H. Deppeler, E. H. Ewertz, S. W. Miller.

At a meeting of the Pressure Vessel Committee it was pointed out that the support of tank manufacturers and manufacturers of electric welding equipment is needed to insure an early start on the extensive test program to be carried on jointly by the American Welding Society and the American Society of Mechanical Engineers.

The meeting of the Structural Steel Welding Committee brought out the fact that funds for a similar structural research program are fully subscribed, assuring the completion of tests to establish unit stresses and other design data in this field.

"Welding Corrosion Resisting Steel Alloys" was the title of a paper by W. B. Miller, of the Union Carbide & Carbon Research Laboratories. Mr. Miller described methods of welding with the oxyacetylene torch and presented test and service results.

A preliminary progress report on qualifications of welders, inspection and supervision was presented by H. H. Moss and A. M. Candy. This covered the fields of structural steel and industrial piping and was followed by prepared discussions covering structural steel, piping and pressure vessels.

The meeting closed with a session on the welding of the new Ford car and a meeting of the American Bureau of Welding at which the progress made by various research committees of the Society was reviewed.

M. I. T. Gas Course Will Begin on June 18

Metallurgy will be the principal study to be taken up at the seventh annual industrial gas course at the Massachusetts Institute of Technology, Cambridge, Mass., which will be conducted this year from June 18 to 28, inclusive. The course is sponsored by the New England Gas Association and the American Gas Association.

Laboratory work and study in metallurgy will be carried on under the direction and guidance of members of the M.I.T. faculty together with many widely known men in the gas industry.

Roller Bearing Co. Acquires Mercer Plant

The Roller Bearing Co. of America, which has been engaged in the manufacture of roller bearings in Newark, N. J., since 1919, has just concluded the purchase of the plant formerly occupied by the Mercer Motor Co. in Trenton, N. J. The Roller Bearing company will install its present equipment in that plant and will obtain a large amount of new equipment required to take care of their growing sales. The Mercer plant occupies 11½ acres and the buildings have 175,000 sq.ft. of floor space. These buildings are of modern mill construction with one story. Railroad sidings serve the plant on two sides.

Joseph C. Trainer, of Philadelphia, is president of the Bearing company, Allen H. Jones, vice-president, John J. Berliss, treasurer, and David H. Litter, secretary.

Homer S. Trecartin is director of sales. Mr. Jones and Mr. Berliss were the founders of the company and are in direct charge of its activities. The concern began operations in Roseville nine years ago, then moved to Belleville, later going to Newark due to expanding busin s.

Obituaries

JAMES C. ARMSTRONG, pioneer foundry and machine shop owner in central Illinois and for several years proprietor of the old Armstrong Machine Works in Peoria, died April 20 at the age of 82 years. He had retired from the industry several years ago.

WILLIAM B. H. DOWSE, president of the United States Fastener Co. and prominent in other industries, died April 20 at his home, West Newton, Mass. Mr. Dowse was 76 years old. He was president of the Reed & Barton Manufacturing Co., Boston; Theodore B. Starr, Inc.; a director of the Waltham Watch Company, and head of a number of metal-working companies.

Business Items

The St. Louis Screw Co. has changed its name to the St. Louis Screw & Bolt Co. There is no change in management.

The Stuebing Cowan Co., of Cincinnati, Ohio, has moved its Holyoke, Mass., plant into larger quarters having 80 per cent more floor space. A complete stock of lift trucks will be carried at the new plant for direct shipment to all Eastern points as far south as Washington.

The Monighan Machine Co., of Chicago, has been reorganized as the Monighan Manufacturing Corporation. The operation of the business will continue along the same lines as before under the management of Oscar J. Martinson, as president; W. T. Brennen, vice-president and treasurer, and H. W. Voss, secretary.

The Lambert Machine & Engineering Co., Cleveland, has taken back full manufacturing rights for its boring mill, which had been sold to the Carroll Foundry & Machine Co., Bucyrus, O. The company's first boring mill was built in 1915 by David Lambert. Later it was sold to the Carroll company.

The Rockford Iron Works, Rockford, Ill., pioneer among foundry plants of the city, has been sold by the local owners to an eastern syndicate composed of I. Patrick, John W. Holstead and John L. Patrick, of New York, and will be continued under its present policy, with prospect that the plant, which now employs a force of 70, will be expanded. D. E. Trahern is retiring president of the company, and H. R. Trahern, vice-president. The plant was established in 1848 by Clark & Utter, being acquired by the Trahern group 28 years ago.

Capital stock of the Montgomery Elevator Co., Moline, Ill., will be increased from $300,000 to $750,000 under amendment to its charter approved by the state department this week. A. E. Montgomery, president, said that the increase does not indicate any immediate expansion of the plant and the new stock will be issued from time to time as conditions make it necessary. The firm recently finished a $100,000 addition to the plant which will provide for normal expansion for some time to come, officers reported.

The Sherwood Sanitary Furnace Co., and the Modern Machine Shop, Inc., both of Danville, Ill., have reached agreement whereby steel work for the Sanitary furnaces will be built and assembled at the Modern Machine Shop. Clarence F. Carter, vice president and general manager, and J. Abbie Miller, secretary-treasurer of the Modern Machine Shop, have become identified with the Sherwood company. Mr. Carter will be general manager and Mr. Miller, secretary-treasurer of the company. The Wabash Valley Manufacturing Co., of Perrysville, Ind., will manufacture castings for the furnace. The furnace is the invention of T. C. Sherwood, president of the company, and embodies several new features of design.

Personals

ROBERT GREGG, president of the Atlantic Steel Co., Atlanta, has been nominated for re-election as vice-president of the Georgia Manufacturers Association for the ensuing year.

W. H. POST has been appointed manager of the Pittsburgh office of the Timken Roller Bearing Service and Sales Co. Mr. Post formerly handled sales work in the Cleveland district.

THOMAS S. STEPHENS, for the past 25 years connected with machinery sales activities of Manning, Maxwell & Moore, Inc., and latterly as manager of railroad machinery sales, has resigned.

HARRY H. LEATHERS, 80 Federal St., Boston, has been appointed New England agent of the American Fluid Motors Co., of Philadelphia. R. L. Sittinger will be associated with Mr. Leathers in sales work.

J. C. GOODNIGHT has joined the sales force of the Detroit office of the Black & Decker Manufacturing Co., of Towson, Md., and will specialize in automotive work. Leon A. Hardy replaces Jack Caffery as salesman in the New York district.

THEODORE BERAN, commercial vice-president of the General Electric Co., in charge of the New York district, has retired. He was elected vice-president in 1926, had been manager of the New York district since 1903.

STANLEY W. PARKER has been appointed district manager of the Chicago office of Wheelock, Lovejoy & Co., Inc., at 35 E. Wacker Drive. Mr. Parker has been metallurgist and sales engineer at the home office of the company in Cambridge, Mass., for the past twelve years.

E. J. CONNOLLY, for many years prominently identified with the development of automobile body engineering and designing has joined the staff of the Hayes Body Corporation according to an announcement from W. W. Hoagland, president. Mr. Connolly will be in charge of the Ionia plant.

JOHN C. SPENCE, works manager, grinding machine division, Norton Co., Worcester, Mass., has resigned. He was a member of the board of directors and active in many other company affairs. He has been associated with the Norton Co. 22 years.

N. H. MADDOX, who for the past twelve years has been identified with the machinery and machine tool business in the Southeast as a salesman, has joined the sales staff of the American Machinery Co., 125 Forsyth St., S. W., Atlanta, distributors of sawmill machinery and supplies, gas motors and machinery.

RALPH SIMPSON has been appointed sales and service representative of the Geometric Tool Co., of New Haven, in eastern New England, including Maine, New Hampshire, Rhode Island, and eastern Massachusetts. Mr. Simpson was formerly sales manager of the Stockbridge Machine Co. He has also been connected with the Potter & Johnston Machine Company.

C. A. WALES, formerly branch manager for Henry Prentiss & Co. of New York City, has joined the sales organization of the Henry G. Thompson & Son Co. of New Haven, Conn., manufacturers of hack saw blades. Mr. Wales, who was also former purchasing agent of the Federal Signal Co., of Albany, N. Y., and president of the Purchasing Agents' Association of Eastern New York, will represent the Thompson company in Ohio.

THOMAS G. NEE, of New York, has been elected president of the Acme Wire Co., New Haven, Conn., to fill the vacancy of Victor M. Tyler, retired. James W. Hook, president of the Geometric Tool Co., was elected chairman of the executive committee. Mr. Nee was also elected to the board to replace James T. Moran, resigned, and W. G. Redfield, president of the New Haven Bank, was also elected to the board to fill the vacancy of J. E. Wheeler, resigned. Mr. Nee for twelve years was vice-president and chief engineer of the Mexican Telephone and Telegraph Co., and in the past ten years has been connected with the Allied Machinery Co., of New York, as president of the Horne Co., Ltd., of Japan, its most important subsidiary.

Forthcoming Meetings

American Society of Mechanical Engineers. Spring Meeting, May 14-16, Pittsburgh, Pa. Calvin W. Rice, secretary, 39 West 39th St., New York City.

American Foundrymen' Association. Convention and Exhibit, Philadelphia, May 14 to 18. Technical Sessions at Hotel Belleview-Stratford; exhibit at Commercial Museum. R. E. Kennedy, secretary, 140 So. Dearborn St., Chicago.

Gray Iron Institute. Open meeting, May 18, Philadelphia Commercial Museum. D. M. Avey, temporary secretary, 1213 W. Third St., Cleveland, Ohio.

Southern Supply & Machinery Dealers' Association. Will meet in annual convention in Nashville, Tenn., May 15, 16 and 17 jointly with the **National Supply & Distributors' Association** and the **American Supply & Machinery Manufacturers' Association.**

Associated Machine Tool Dealers. Annual spring meeting, May 23 to 26, at Granville, Ohio. E. P. Essley, secretary, 551 W. Washington Blvd., Chicago.

National Association of Foremen. Fifth annual convention, May 25 and 26, at Canton, Ohio. E. H. Tingley, secretary, 1249 Unity Bank Building, Dayton, Ohio.

National Association of Purchasing Agents. Annual meeting and "Informashow," Kansas City, Mo., May 28 to 31. W. L. Chandler, secretary, 11 Park Place, New York.

American Railway Association. Schedule of sectional meetings: Division V, mechanical, June 20 to 27, Atlantic City, N. J.; Division VI, Purchases and Stores, June 20 to 22, Atlantic City, N. J.; Division VII, Electrical, Sept. 22 to 28, Cleveland, Ohio. J. W. Welsh, secretary, 292 Madison Avenue, New York City.

Association of Iron and Steel Electrical Engineers. Annual meeting, Stevens Hotel, Chicago, June 25 to 29. J. F. Kelly, managing director, Empire Bldg., Pittsburgh, Pa.

American Society for Testing Materials. Annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., June 25 to 29. C. L. Warwick, secretary, 1315 Spruce St., Philadelphia, Pa.

Society of Automotive Engineers. 1928 Summer Meeting, Chateau Frontenac, Quebec, Canada, June 26 to 29. C. E. Heywood, in charge of meetings, 29 West 39th St., New York.

Canada's Steel and Power Show. Second annual show to be held at the University of Toronto Arena, Sept. 4-7. Secretary, Campbell Bradshaw, 24 Front St., Toronto, Ontario.

American Railway Tool Foremen's Association. Annual meeting, Hotel Sherman, Chicago, Sept. 12, 13 and 14. G. G. Macina, secretary, 11402 Calumet Ave., Chicago.

American Railway Tool Foreman's Association. Sixteenth annual convention of the Supply Association, Hotel Sherman, Chicago, Sept. 12, 13 and 14. F. A. Armstrong, secretary, the Pratt & Whitney Co., 564 W. Monroe St., Chicago.

National Safety Council. Seventeenth annual safety congress will be held in New York, October 1-5. Idabelle Stevenson, executive secretary, 1 Park Ave., New York.

American Society for Steel Treating. "National Metals Exposition," Commercial Museum, Philadelphia, Pa., week of Oct. 8. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

The Weekly Price Guide

Rise and Fall of the Market

STEEL mill operations have slowed down to 80 per cent of capacity, as against 85 per cent a week ago in the Pittsburgh district. Corporation plants are still at 88@90 per cent of capacity. The principal hot-rolled steel products are $1.85@$1.90 per 100 lb., Pittsburgh, compared with a flat rate of $1.90, one month ago. Steel sheets are off $1@$3 per ton at mill; wire demand is weak. Active buying is evident in steel pipe and reinforcing material for road construction. Scrap continues scarcer, with prices firm except in heavy yellow brass. Prices of non-ferrous materials are uneven.

(All prices as of April 27)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$21.44
Northern Basic	20.89
Southern Ohio No. 2	21.19
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	25.62
BIRMINGHAM	
No. 2 Foundry	16.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	21.76
Virginia No. 2	27.17
Basic	21.26
CHICAGO	
No. 2 Foundry local (silicon 1.75@2.25)	20.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	22.80
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	20.26
Basic	19.26
Bessemer	21.26

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.50@4.75
Cleveland	5.00
Cincinnati	4.30
New York	5.25
Chicago	4.50@4.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	Chicago	Cleveland	New York
No. 10	2.10@2.20	3.50	3.25	3.90*
No. 12	2.15@2.25	3.55	3.30	3.95*
No. 14	2.20@2.30	3.60	3.35	4.00*
No. 16	2.30@2.40	3.70	3.45	4.10*
Black				
Nos. 18 to 20	2.60@2.70	3.75	3.55	4.00
No. 22	2.75@2.85	3.90	3.70	4.15
No. 24	2.80@2.90	3.95	3.75	4.20
No. 26	2.90@3.00	4.05	3.85	4.30
No. 28	3.05@3.15	4.20	4.00	4.45
Galvanized				
No. 10	2.95@3.05	4.10	3.90	4.25
Nos. 12 to 14	3.05@3.15	4.20	4.00	4.35
No. 16	3.15@3.25	4.30	4.10	4.45
No. 18	3.30@3.40	4.45	4.25	4.60
No. 20	3.45@3.55	4.60	4.45	4.75
No. 22	3.50@3.60	4.65	4.50	4.80
No. 24	3.65@3.75	4.80	4.60	4.95
No. 26	3.90@4.00	5.05	4.85	5.20
No. 28	4.15@4.25	5.30	5.10	5.45

*250 to 3,999 lb.; 249 lb. and under plus extra of 50c. per net order.

WELDED STEEL PIPE—Warehouse discounts are as follows:

	New York		Cleveland		Chicago	
	Black	Galv.	Black	Galv.	Black	Galv.
1 to 3 in. steel butt welded.	53%	39%	55½%	43½%	54%	41%
2½ to 6 in. steel lap welded.	48%	35%	53½%	40½%	51%	38%

WROUGHT STEEL PIPE LIST

Size, Inches	List Price per Foot	—Diameter in Inches— External	Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following net prices are for seamless mechanical tubing, cold drawn, round, .10 to .30 carbon, at New York warehouse in lots of less than 100 ft. or 100 lb.:

—Thickness— Decimal	B.w.g. and Fractions	Outside Diameter in Inches ½	⅝	¾	⅞	1	1⅛	1¼
		Price per Foot						
.035″	20	$0.15	$0.16	$0.17	$0.18	$0.19	$0.21	$0.23
.049″	18	.17	.18	.19	.20	.21	.23	.25
.065″	16	.19	.20	.21	.22	.23	.25	.27
.083″	14	.20	.22	.23	.24	.25	.27	.29
.095″	13	.21	.23	.25	.26	.27	.29	.31
.109″	12	.22	.24	.26	.27	.28	.30	.32
.120″ or .125″	11	.23	.25	.27	.28	.29	.31	.33
.134″	10	.24	.26	.28	.29	.30	.32	.34

MISCELLANEOUS—Warehouse base prices in cents per lb.:

	New York	Cleveland	Chicago
Spring steel, light*	4.50	4.65	4.65
Spring steel, heavier	4.00	4.00	4.00
Coppered Bessemer rods	6.05	6.00	6.20
Hoop steel	4.50‡	4.00	4.15
Cold rolled strip steel	6.25	6.00	6.10
Floor plates	5.10‡	5.30	5.00
Cold drawn, round or hexagon†	3.40	3.65	3.60
Cold drawn, flat or square†	3.90	4.15	4.10
Structural shapes	3.30‡	3.00	3.10
Soft steel bars	3.25‡	3.00	3.00
Soft steel bar shapes	3.25‡	3.00	3.00
Soft steel bands	4.00‡	3.65	3.65
Tank plates	3.30‡	3.00	3.10
Bar iron (2.75 at mill)	3.24	3.00	3.00
Drill rod (from list)	60%	55%	50%

*Flat, $\frac{3}{16}$@½-in. thick. †Cold finished steel, shafting and screw stock. ‡250 to 3,999 lb., ordered and released for shipment at one time.

Electric welding wire, New York, $\frac{3}{32}$, 8.35c.; $\frac{1}{8}$, 7.85c.; $\frac{5}{32}$ to $\frac{1}{4}$ 7.35c. per lb.

METALS

Warehouse Prices in Cents Per Pound for Small Lots:

Copper, electrolytic, New York			15.00
Tin, straits, pigs, New York			54.50
Lead, pigs, E. St. Louis	6.00	New York	7.00
Zinc, slabs, E. St. Louis	5.80	New York	6.75

	New York	Cleveland	Chicago
Antimony, slabs	12.50	13.25	14.25
Copper sheets, base	23.00	23.00	22.75
Copper wire, base	19.50	19.62½	16½ (mill)
Copper bars, base	21.50	21.50	22.25
Copper tubing, base	24.50	24.50	24.50
Brass sheets, high, base	18.75	18.75	18.75
Brass tubing, high, base	23.62½	23.62½	23.62½
Brass rods, high, base	16.50	16.50	16.50
Brass wire, high, base	19.25	19.50	19.25

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminum ingots, 99%	25@26*	22½@24	24.30
Zinc sheets (casks)	9.50@10.00	10.75	10.36
Solder (strictly)	33.50	32.50	33@37
Babbitt metal, delivered, New York, cents per lb.:			
Genuine, highest grade			70.00
Commercial genuine, intermediate grade			63.00
Anti-friction metal, general service			31.50
No. 4 babbitt (f.o.b.)			12.00
Nickel, f.o.b. refinery, cents per lb.:			
Ingots 35.00	Electrolytic 37.00	Shot	36.00

*Delivered.

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Full finished nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	45.00
Cold drawn rods, Grade "A" (base)	53.00

Base price of Monel metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	28.00	Hot rolled rods (base)	35.00
Blocks	28.00	Cold drawn rods (base)	43.00
Cold rolled sheets (base)	50.00	Full finished sheets (base)	42.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible copper	12.37½@12.62½	11.50	11.25@11.75
Copper, heavy, and wire	11.50 @12.37½	10.75	10.75@11.25
Copper, light, and bottoms	10.25 @10.75	9.50	9.50@10.00
Heavy lead	5.00 @ 5.25	5.25	4.25@ 4.75
Tea lead	3.75 @ 4.00	3.75	3.25@ 3.75
Brass, heavy, yellow	7.12½@ 7.37½	7.25	7.00@ 7.50
Brass, heavy, red	9.25 @ 9.75	9.75	9.00@ 9.25
Brass, light	5.50 @ 6.00	5.75	6.00@ 6.50
No. 1 yellow rod turnings	7.50 @ 8.00	7.50	7.00@ 7.50
Zinc	3.25 @ 3.50	3.25	2.50@ 3.00

TIN PLATES—Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$12.10	$11.95	$11.50
"A" Grade:				
IC,	14x20	9.70	9.90	9.50
	Coke Plates—Primes—Per box			
100-lb.,	14x20	6.45	6.10	7.00
	Terne Plates—Small lots, 8-lb. Coating—Per box			
IC,	14x20	7.75@8.00	7.00	7.50

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb. ‡	$0.10@0.13½	$0.16	$0.15
Cotton waste, colored, per lb. ‡	.09@ .13	.12	.12
Wiping cloths, washed white, per lb	.15@.17½	38.00 per M	.15
Sal soda, per lb	.02	.02	.02¾
Roll sulphur, per lb	.027	.03½	.04
Linseed oil, raw, per 7½-lb. gal., 5 bbl. lots	.76½	.84	.78
Lard cutting oil, 25% lard, in 5 gal. cans, per gal.	.65	.60	.60
Machine oil, medium-bodied (55 gal. steel bbl.) per gal	.30	.36	.36
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin.ft. per inch of width for single ply.			
Medium grade	35%	35%	35%
Heavy grade	30%	30%	30%
Rubber transmission, 6-in., 6 ply, $1.83 per lin.ft.			
First grade	45%	50–10%	50%*
Second grade	50%	60–5%	50–10%†

*Large quantities, 60%. †Large quantities, 60–10%. ‡Bale lots.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb	$0.0325	$0.0324	$0.0324
Cold drawn shafting	per lb	.034	.034	.04
Brass rods	per lb	.165	.165	.1587½
Solder (½ and ½)	per lb	.335	.34	.415
Cotton waste, white	per lb	.10@.13½	.10@.13½	.10@.13½
Emery disks, cloth, No. 1, 6-in. dia	per 100	3.10	3.10	3.10
Lard cutting oil	per gal	.65	.65	.55
Machine oil	per gal	.30	.30	.33
Belting, leather, medium	off list	35%	35%	40–5%
Machine bolts, up to 1x30 in., full kegs	off list	50%*	50%*	50%*

*List prices as of April 1, 1927.

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—Standard grade, in sheets 9x11 in., No. 1, per ream of 480 sheets:			
*Flint paper	$5.40	$4.95	$5.13
*Emery paper	10.71	9.15	10.71
†Emery cloth	27.84	27.85	27.84
Emery disks, 6 in. dia., No. 1, per 100:			
Paper	1.29	1.27	1.32
Cloth	3.10	3.05	3.05
Fire clay, per 100 lb. bag	1.00	.75	.75
Coke, prompt furnace, per net ton	Connellsville,		2.60@2.75
Coke, prompt foundry, per net ton	Connellsville,		3.75@4.50
White lead, dry or in oil	100 lb. kegs	New York,	13.75
Red lead, dry	100 lb. kegs	New York,	13.75
Red lead, in oil	100 lb. kegs	New York,	15.25

*4½ reams and under. †Less than 2 reams.

SHOP SUPPLIES

Discounts from new list dated Apr. 1, 1927, applying on immediate deliveries from warehouse stocks in New York and vicinity:

	Full Kegs or Cases
Machine bolts, square heads and nuts:	
Up to ¾ x 6-in.	55%
Larger up to 1 x 30-in.	50%
1⅛ and 1¼ in. dia.	35%
Carriage bolts:	
Up to ½ x 6-in.	55%
Larger sizes	50%
Coach and lag screws:	
Up to ½ x 6-in.	55%
Larger sizes	50%
Tap bolts, hexagonal heads	40%
Nuts:	
Hot pressed, square and hexagonal, blank or tapped, up to 1-in., incl.	55%
Cold punched, square and hexagonal, blank or tapped, up to 1-in. incl.	55%
Semi-finished, hexagonal, tapped, in packages, all sizes	40%
Case hardened, hexagonal, tapped, in packages, all sizes	30%
Washers: Deduct from list, per 100 lb	$3.50*
Rivets, button and cone head:	
Small, including ½-in. dia	50–10%
Large (base) per 100 lb. net	$5.00†

Note—For less than case or keg quantities on bolts, screws, hot-pressed and cold-punched nuts, add extra of 10 per cent to list.

*Broken keg lots, $1.50 off list. †Broken keg lots, $6.50 net.

Machine Requirements and Industrial Construction

Equipment Wanted

Ill., Mendota—H. D. Conkey Co.—50 ton vertical hydraulic press.

Md., Baltimore—Bd. of Awards, City Hall,—will receive bids until May 9, for machinery and equipment for machine, electrical and woodworking shops for Dept. of Education.

Mich., Detroit—Universal Products Co., 6455 Kingsley Ave.—machine shop equipment for new addition to plant for the manufacture of small auto parts.

Mich., Detroit—White Motor Co., East 79th St. and St. Clair Ave., Cleveland, O.—machine equipment for proposed 1 story, 190 x 205 ft. sales and service building on Twelfth St. here. Estimated cost $150,000.

Mich., Jackson — Macklin Mfg. Co., T. McIntyre, Pres.—machinery and equipment for the manufacture of automobile wheels, also four baking kilns.

Mich., Jackson—Weatherwax Supply Co.—7½ to 10 ton electric crane, 3 motor, 40 ft. span.

Mich., Monroe—Monroe Auto Equipment Co., East First St.—machine shop equipment for proposed addition to auto factory. Estimated cost $50,000.

N. J., East Orange—Bd. of Education, 19 Winans St.—will receive bids until May 7 for one Brown & Sharpe No. 1, 10 x 24 in. universal grinder with equipment including drive pulleys and belts.

N. J., Newark—Bd. of Education, City Hall—will receive bids until May 9, for metalworking, woodworking and type casting machinery, blue-print machines, etc.

O., Cleveland — Bd. of Education, F. G. Hogen, Dir., woodworking equipment for proposed 3 story, 160 x 292 ft. junior high school at Benham and East Boulevard Sts. and 3 story, 176 x 291 ft. junior high school at Bosworth St. and Parkhurst Dr. Estimated cost $650,000 each.

Pa., Pittsburgh — General Electric Co., River Rd., Schenectady, N. Y.—four lathes, head drill, grinder, saw, milling machine and power press for plant here.

Pa., Pittsburgh — Pennsylvania R.R., Broad St. Station, C. D. Young, Gen. Purch. Agt., Philadelphia—one centerless grinder for shop here.

Pa., Wilmerding—Westinghouse Airbrake Co.—two grinders.

Tex., San Antonio — Texas Airplane Corp., Route 1, Box 101—prices and catalogs on machinery and equipment for airplane repair shop, etc.

Ont., Wallaceburg — Beebe Bros. — prices and catalogs on equipment and marine engines for boat building plant recently destroyed by fire.

Opportunities for Future Business

Ala., Tuscaloosa—E. Z. Opener Bag Co., Decatur, Ill., plans the construction of a group of buildings including 100 x 100 ft. machine shop, etc. W. E. Spink, Pere Marquette Bldg., New Orleans, La., Archt.

Calif., San Francisco — International Harvester Co., 201 Potrero Ave., awarded contract for a 2 story factory at 15th and Potrero Ave. Estimated cost $45,000.

Conn., West Haven (New Haven P. O.)—Western Electric Co., 80 John St., New Haven, is receiving bids for a 2 story factory here. Estimated cost $50,000. Private plans.

Ill., Chicago—Crane Co., 156 North Jefferson Ave., awarded contract for a 1 story, 43 x 109 ft. addition to garage and repair shop. Estimated cost $83,000.

Ill., Chicago—Illinois Copper & Iron Co., 217 Maplewood St., is receiving bids for a 1 story, 48 x 100 ft. factory for the manufacture of jacketed kettles, expansion joints, varnish kettles and repair work. E. J. Patelski, 179 North Wells St., Archt.

Ill., Moline—John Deere Harvester Co., 504 Third Ave., awarded contract for a foundry at Third Ave. and 13th St.

Ia., Cedar Rapids—C. A. Kool, Knoxville, has work under way on a 2 story, 120 x 140 ft. repair and service garage at Seventh St. and Second Ave. E. Estimated cost $35,000.

Ia., Dubuque—Belsky Motor Co., Eighth and Iowa Sts., will soon receive bids for a 1 story repair and service garage at 6th and Iowa Sts. Estimated cost $30,000. C. I. Krajewski, 730 Main St., Archt.

Ia., Sioux City — Sioux City Box Co., F. M. Wilson, Pres., 608 Cook St., awarded contract for a factory at Fifth Ave. and Water St. Estimated cost $25,000.

Mass., Boston—Charles St. Garage Corp., L. K. Morse, Pres., will soon receive bids for a 3 story, 80 x 100 ft. addition to repair and service garage at 252 Cambridge St. Lockwood, Greene & Co., 24 Federal St., Archts. Noted Feb. 16.

Mass., Cambridge (Boston P .O.)—Cambridge Salvage & Supply Co., 91 Broadway, is receiving bids for a 2 story, 70 x 95 ft. factory. Estimated cost $40,000. N. R. Willard, 402 Massachusetts Ave., Arlington, Archt.

Minn., Minneapolis—Twin City Motor Bus Co., 164 West Fifth St., St. Paul, awarded contract for a 1 story, 120 x 140 ft. repair and service garage at Chestnut Ave. and 16th St. N. here. Estimated cost $50,000.

Neb., Hastings—Hastings Casket Co., F. A. Mitchell, Secy., awarded contract for a 2 story factory. Noted Apr. 19.

Neb., Omaha—Paxton-Mitchell Co., J. L. Paxton, Pres., 2614 Martha St., awarded contract for a 1 story, 92 x 162 ft. iron foundry at 27th Ave. and Martha St. Estimated cost $50,000. Noted Mar. 1.

N. J., Bayonne — Bayonne Bolt Corp., E. L. Rupf, Pres., Trash Ave. and Second St., plans a 1 story factory on First St. Estimated cost $100,000. Architect not selected.

N. J., Jersey City—H. E. Salzberg & Co. Inc., 54 Brook St., manufacturers of electrical machinery, is having plans prepared for a 1 story, 50 x 214 ft. factory at Water and Clark Sts. Estimated cost $50,000. Private plans.

N. Y., Brooklyn—A. Bruzzessi, 391 Fulton St., had plans prepared for a 1 story, 37 x 65 ft. garage at 15th Ave. and 63rd St. Estimated cost $60,000. Lama & Proskaner, 391 Fulton St., are architects.

N. Y., Brooklyn—F. G. S. Holding Corp., J. H. Finck, Pres., 36 Bay 37th St., had plans prepared for a 2 story, 70 x 71 ft. garage at West 9th St. and Ave. P. Estimated cost $70,000. S. Gardstein, 44 Court St., Archt.

N. Y., Brooklyn—M. E. Pellegrini, 2148 Ocean Ave., will soon receive bids for the construction of a garage, etc. on Ocean Ave. and Ave Y. Estimated cost $78,000. I. H. Lanzalone, 60 Jefferson St., Archt. Noted Apr. 26.

N. Y., Brooklyn—F. F. Pannaman, 26 Court St., Archt., will soon receive bids for the construction of a garage at Gravesend Ave. and Ave. M for S. & A. Ragonesi, 2063 61st St. Estimated cost $50,000. Noted Apr. 19.

N. Y., Brooklyn—Reid Ice Cream Corp., 524 Waverly Ave., had plans prepared for a 3 story garage, shop, etc. at Waverly and Atlantic Aves. Estimated cost $90,000. Kleineit & Klie, 250 Park Ave., New York, Archts. J. Reydel Jr., 705 East 24th St., New York, Asso. Archt.

N. Y., Brooklyn—R. Von Lehn Jr., 464 East 24th St., had plans prepared for a 1 story, 100 x 100 ft. garage at 6th St. and Third Ave. Estimated cost $75,000. G. Alexander Jr., 2996 Bedford Ave. Estimated cost $75,000.

N. Y., Brooklyn—Voorland Builders, Inc., prepared for a 567 Ashford St., had plans B. Rich, Pres.,1 story, 180 x 200 ft. garage, etc. at Coney Island and Voorheis Aves. Estimated cost $40,000. Malkind & Weinstein, 93 Court St., Archts.

N. Y., Corona (Flushing P. O.)—Philbin Realty Co. Inc., Bank of Manhattan Bldg., Long Island City, had plans prepared for a 2 story 115 x 150 ft. garage at Junction Blvd. and 37th Ave. here. Estimated cost $50,000. W. Shary, 41 Union Sq., New York, N. Y., Archt.

N. Y., New York—Samuel Katzen, 1824 Arthur Ave., had plans prepared for a 1 story, 122 x 185 ft. garage at University Ave. and 167th St. Estimated cost $40,000. E. Muller, 115 Nassau St., Archt.

N. Y., New York — Shergold Building Corp., P. Gould, Pres., 505 East Tremont Ave., had plans prepared for a 2 story, 100 x 130 ft. garage at Cromwell Ave. and 170th St. Estimated cost $100,000. Glick & Duma, 400 East Fordham Rd., Archts.

N. D., Bismarck—Stair Motor Co., 606 Main St., awarded contract for a 1 story, 100 x 100 ft. repair and service garage. Estimated cost $30,000. Noted Apr. 5.

N. D., Watford City — H. W. Thomas, will soon receive bids for a 1 story, 75 x 100 ft. repair and service garage. Estimated cost $28,000. I. L. Rush, 3 New Tompkins Blk., Minot, Archt.

O., Columbus—E. M. Hulse & Co., 153 West Fulton St., manufacturers of furniture, awarded contract for a 3 story, 100 x 200 ft. factory at West Goodale St. and Olentangy River. Estimated cost $200,000.

O., Willoughby—The Economy Engineering Co., F. O. Andrews, Pres. and Mgr., awarded contract for a 1 story addition to factory for the manufacture of automatic bolt and nut machinery.

Okla., Ponca City — Airmotor Corp., is having preliminary plans prepared for the construction of an airplane factory. Estimated cost $25,000. Private plans.

Pa., Downingtown—Downingtown Motor Co. will soon award contract for a 1 and 2 story, 109 x 130 and 32 x 56 ft. sales and service station. Estimated cost $150,000. Wilson, Eyre & McIlvaine, 1003 Spruce St., Philadelphia, Archts.

Pa., Pittsburgh—Mine Safety Appliance Co., Braddock Ave., awarded contract for a 1 and 4 story addition to factory. Estimated cost $90,000. Noted Mar. 22.

R. I., Providence—Knight St. Garage, 303 Knight St., plans the construction of a 1 story garage and repair shop at Knight and Washington Sts. F. Chiaverini, 32 Broadway, Archt.

R. I., Pawtucket—Collyer Insulated Wire Co., 249 North Main St., awarded contract for a 3 story, 80 x 106 ft. addition to factory on North Main St. Estimated cost $100,000.

S. C., Spartanburg — Standard Looms, Inc., I. Andrews, Pres., 519 East Main St., is having preliminary plans prepared for the construction of factory including assembling plant, machine shops, foundry, etc. Estimated cost $200,000. Lockwood, Greene & Co., Piedmont Bldg., Charlotte, N. C., Engrs.

Texas—Missouri-Kansas-Texas R.R., St. Louis, Mo., plans extensions and improvements to existing shop facilities, etc. here. Estimated total cost $4,334,000. F. Ringer, Ch. Engr.

Ont., Hamilton—Carters Ltd., 65 York St., awarded contract for a 2 story, 100 x 108 ft. garage and service station. Estimated cost $150,000.

Ont., Toront—Reid & Brown, Asplanade St. E., awarded contract for the construction of a steel fabricating plant. Estimated cost $200,000. Noted Apr. 5.